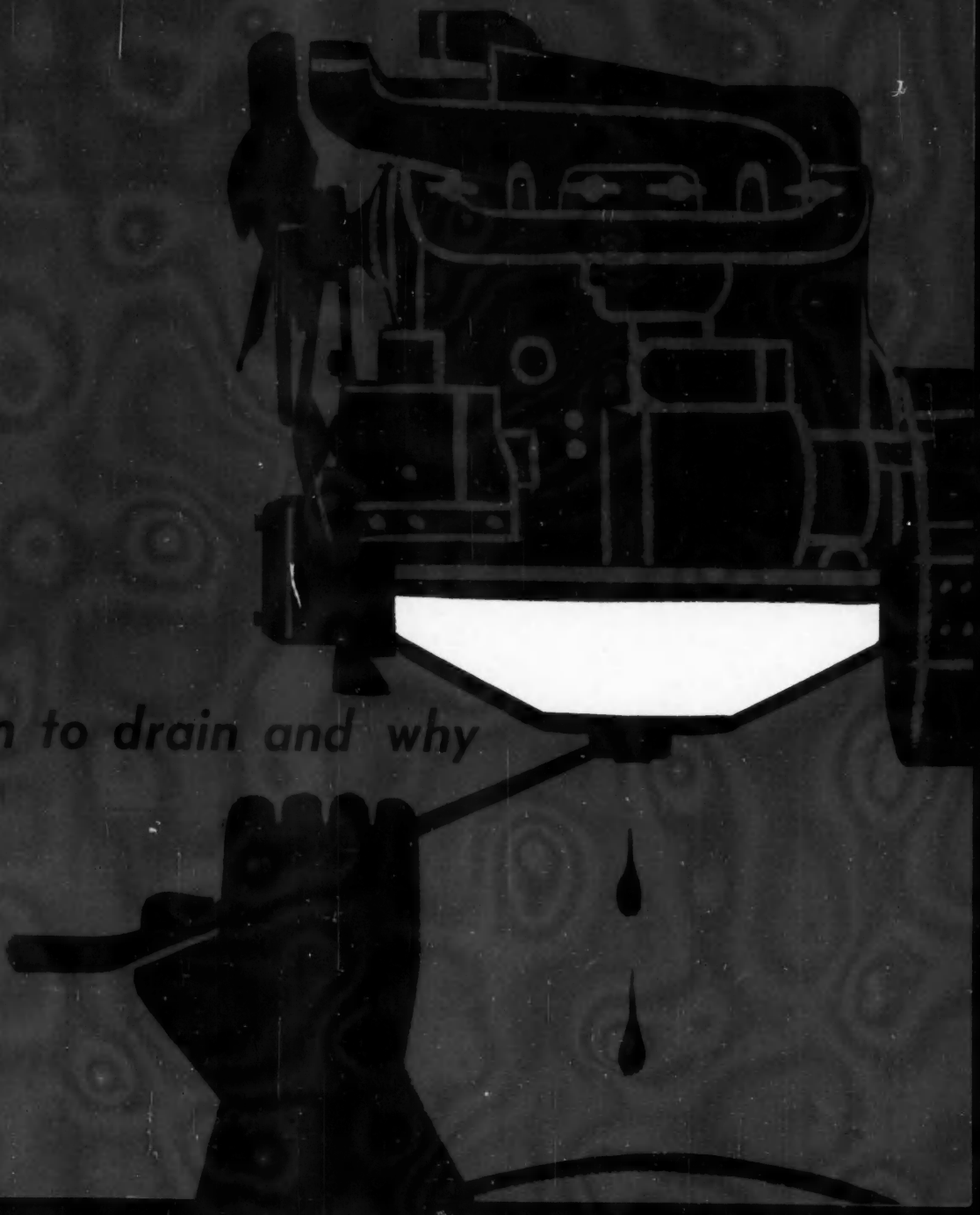
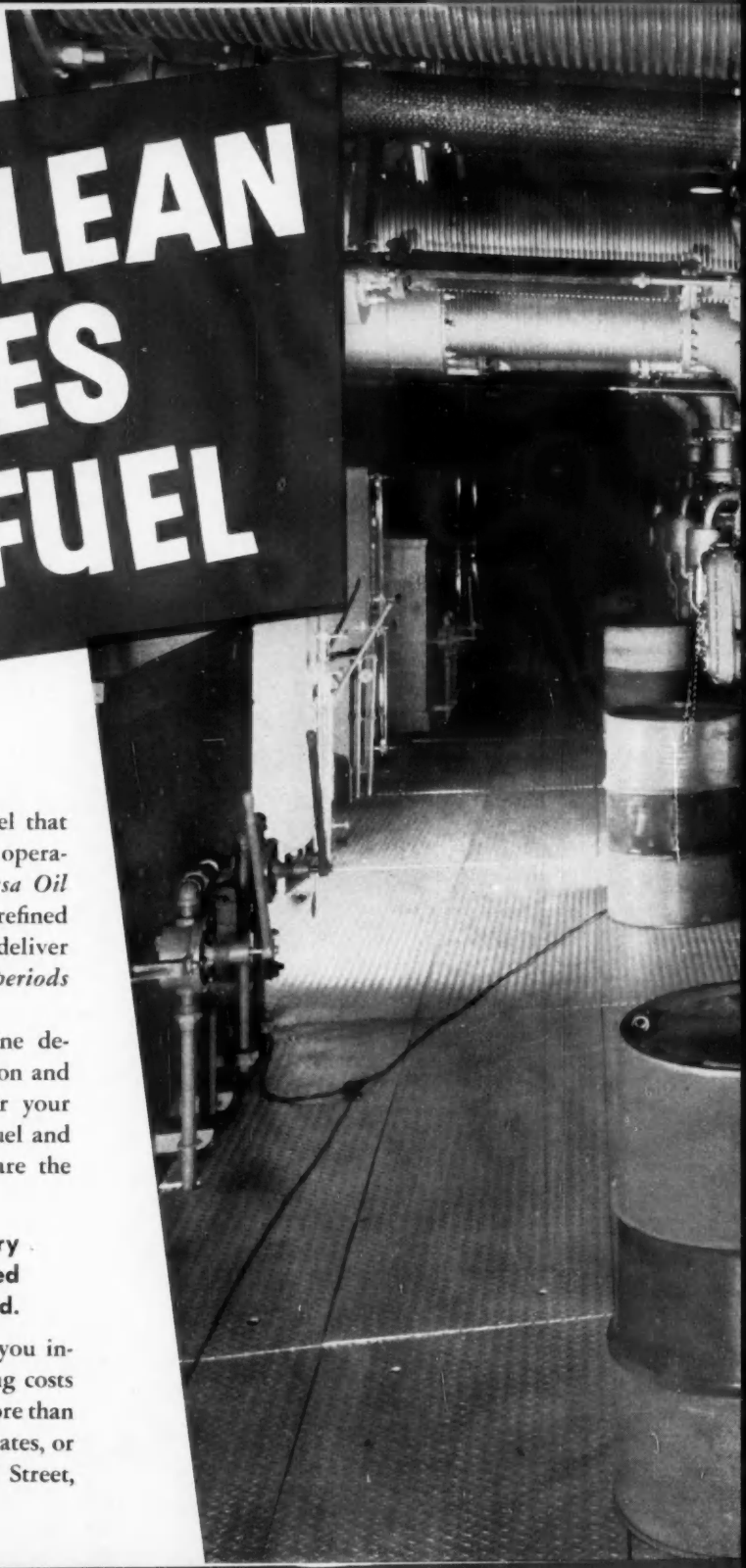
diesel power

March 1955



when to drain and why

RUNS CLEAN ...USES LESS FUEL



YOU CAN say that again—the diesel that runs clean uses less fuel. That's why so many operators rely on one of the famous *Texaco Ursa Oil* series—the lubricating oils that are especially refined to make diesel, gas and dual-fuel engines deliver *more power* with *less fuel* over *longer periods* between overhauls.

Texaco Ursa Oils prevent harmful engine deposits, keep rings free for proper compression and combustion. Thus, you get the full power your engines were designed to deliver, use less fuel and keep your maintenance costs low. These are the benefits that account for the fact that—

For over 20 years, more stationary diesel h.p. in the U.S. has been lubricated with Texaco than with any other brand.

Let a Texaco Lubrication Engineer help you increase the efficiency and reduce the operating costs of your engines. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TUNE IN:
TEXACO STAR THEATER
starring
DONALD O'CONNOR
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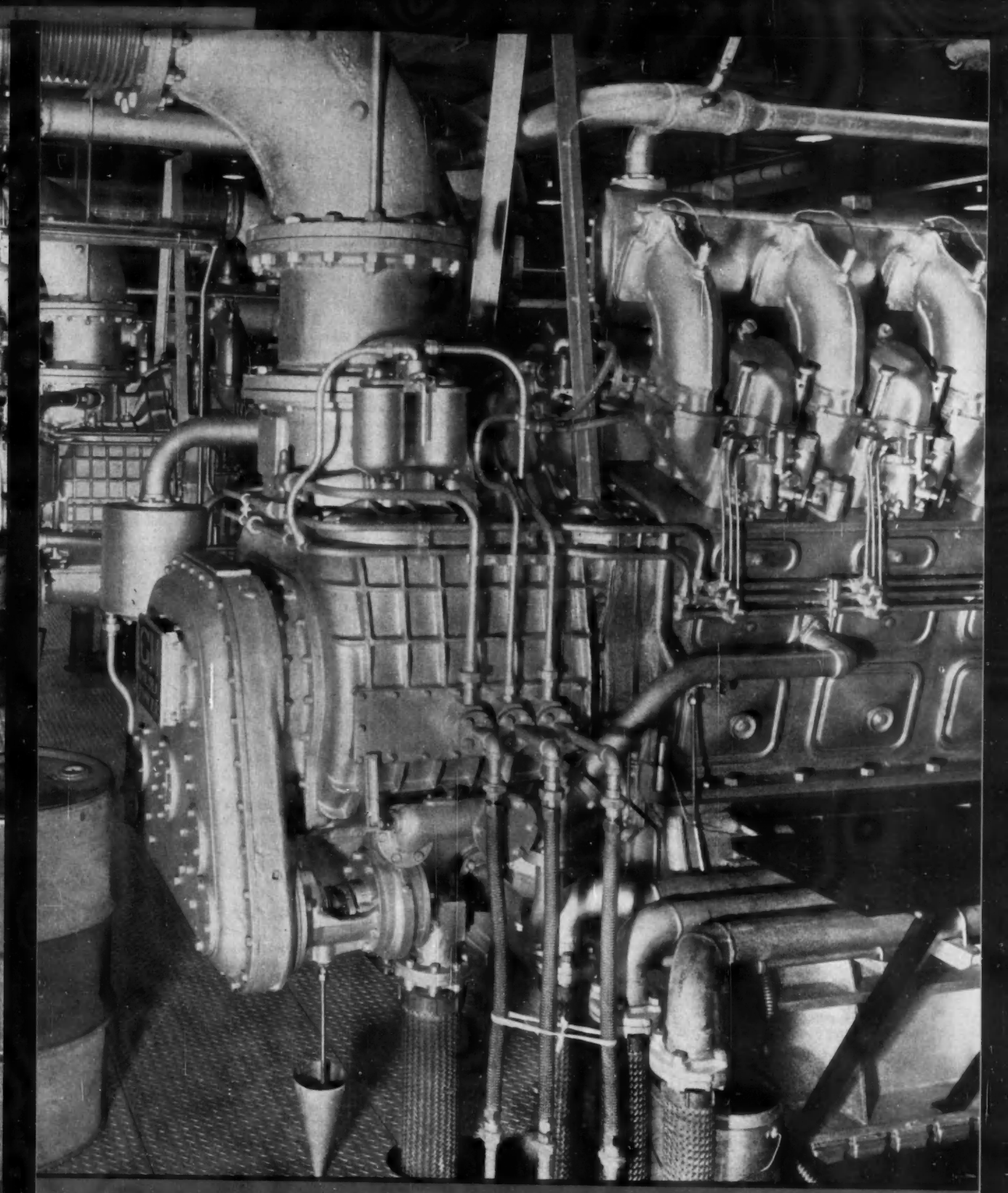
radio broadcasts
Saturday afternoons.

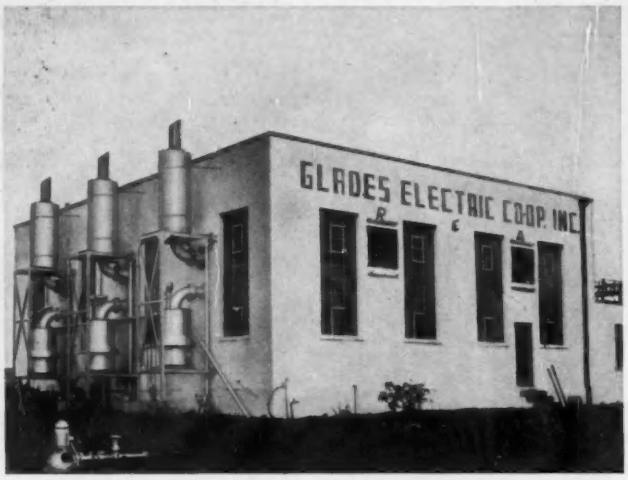
TEXACO

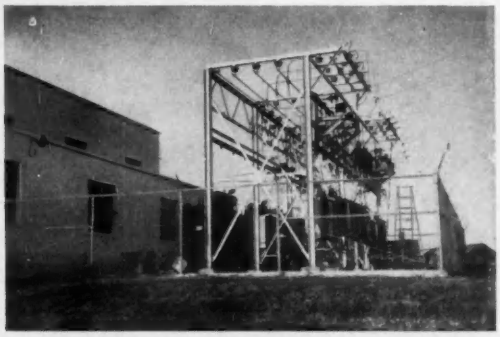
TEXACO



URSA OILS

FOR ALL DIESEL, GAS
AND DUAL-FUEL ENGINES

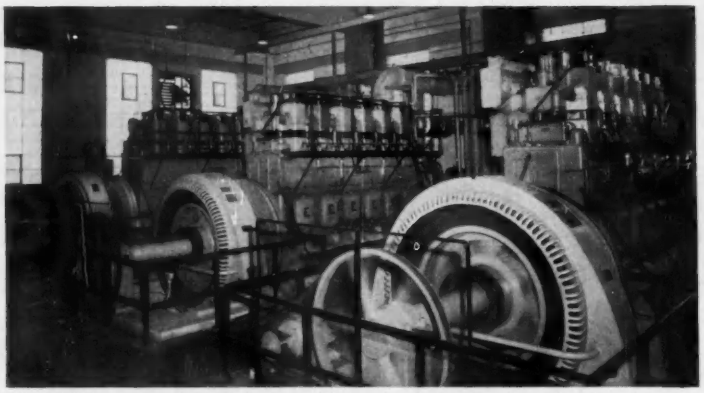




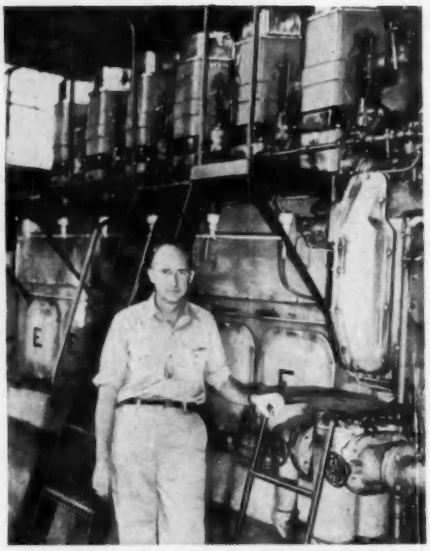
2500 KW Enterprise-powered REA Co-op serves homes, business, industry and agriculture in broad area up to 450 miles distant. New plant has never had a power failure.

Two Enterprise Model DSQ-36 Diesels, each rated 1200 HP at 327 RPM, were installed in 1948, followed by third in 1952. Economical operation has reflected in reduced KW cost.

REA Co-op proves Enterprise dependability —no power failures here!



Since 1948 not one of the Turbocharged Enterprise Engines has been shut down for more than two hours for minor repairs or adjustment—even when operating at peak load of at least 20 out of 24 hours, six months at a time.



W. B. Irby, Jr., the Glades manager says: *"Our excellent operating record speaks for itself, and certainly speaks well for both my Superintendent, Mr. Keenan, and Enterprise Engine & Machinery Co. If we have our choice, we will never have anyhing in our plant but an Enterprise."*

If power failed at Moore Haven, located in the heart of Florida's hurricane belt, untold loss of life and property could result. That's why Glades Electric Co-op, Inc. installed two heavy-duty Enterprise Engines when it repowered its plant in 1948.

Four years later this plant added its third Enterprise Engine, boosting total capacity to 2500 KW—and the security of a completely adequate and dependable generating plant capable of meeting maximum power requirements—normal or emergency.

Whatever the municipal power application, specify Enterprise Engines for *security* . . . units from 73 to 6150 HP for stationary or portable electric service, flood or water pumping systems, sewage plant power. Write Enterprise direct about your problem, or contact the Enterprise sales engineer in your area, today.

Over a million horsepower at work the world over!

ENTERPRISE dependable ENGINES

THE SWITCH IS TO ENTERPRISE
CHOICE OF POWER EXPERTS

ENTERPRISE ENGINE & MACHINERY CO. • Subsidiary of General Metals Corporation • 18th and Florida Streets, San Francisco 10, California

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diesel power

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ELECTRIC POWER

DELCO-REMY ThunderVolt A.C. GENERATORS HEAVY-DUTY (180-Ampere Output Capacity)

Delco-Remy ThunderVolt A.C. generators are the hearts of 12-volt A.C.-D.C. electrical systems designed specifically for modern Diesel buses with fluorescent lighting and extra-heavy electrical loads.

Desirable performance characteristics include cut-in at low generator rpm . . . maximum output of 180 amperes at approximately 2000 rpm. The new generators supply not only alternating current for fluorescent lights but also ample direct current for the heaviest electrical loads coupled with lengthy engine-at-idle periods.

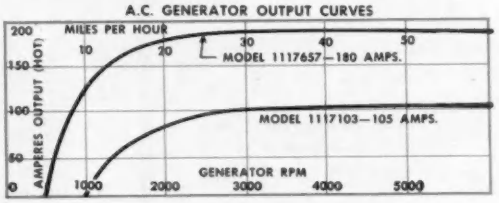
Impressive features of the new generators are their light weight, very high output capacity, and ability to operate over a wide speed range with greatest efficiency. Specify Delco-Remy electrical equipment on your new buses.

A.C. GENERATOR PERFORMANCE DATA

Model	Volts	Cut-In RPM*	Curb Idle Amperes*	Maximum Amperes	Power Watts	Recommended For
1117103	12	975	6	105	1260	All speeds.
1117657	12	625	100	180	2160	All speeds.
1117062-3-4	6	750	30-40	90	540	All speeds.

*APPROXIMATE (BASED ON 100 GENERATOR RPM/MPH)

A.C. GENERATOR OUTPUT CURVES



DELCO-REMY ThunderVolt D.C. SPLIT-FIELD GENERATOR HEAVY-DUTY (120-Ampere Output Capacity)

The Delco-Remy 12-volt split-field generator and its companion regulator are rugged and dependable—designed to meet the needs of Diesel transit buses having increased electrical loads coupled with a high percentage of engine idling time.

Desirable performance characteristics include low cut-in, high output at engine idle, and quick attainment of maximum output. Note performance table at right.

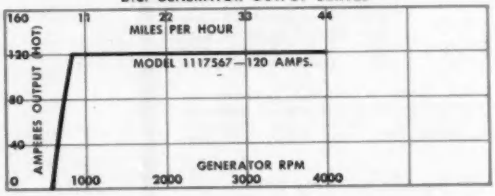
Operating benefits include reduced battery cycling, long battery life, and a simplified electrical system with sustained voltage—at no sacrifice in ruggedness or dependability.

D.C. GENERATOR PERFORMANCE DATA

Model	Volts	Cut-In RPM*	Curb Idle Amperes*	Maximum Amperes	Power Watts	Recommended For
1117567	12	550	70	120	1440	Low speed & idling.

*APPROXIMATE (BASED ON 100 GENERATOR RPM/MPH)

D.C. GENERATOR OUTPUT CURVES



Delco-Remy
ThunderVolt
ELECTRICAL SYSTEMS

DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

right for the job

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WHEREVER WHEELS TURN OR PROPELLERS SPIN

Model 145 Dart Truck equipped with Allison TORQMATIC DRIVE being loaded at Sunnyhill Coal Company's New Lexington, Ohio, mine. Truck is one of 10 operated by Sunnyhill.

10 trucks replace 30 –cut costs 62%

WHEN 10 50-ton trucks equipped with Allison TORQMATIC DRIVES replaced 30 mechanical-drive 20- and 30-ton trucks at Sunnyhill Coal Company's New Lexington mine:

Operating costs dropped *18.6¢ per ton,*

Maintenance costs were cut *13.1¢ per ton,*

And the TORQMATIC-*equipped trucks now haul 32.6* more *tons per truck hour.*

But lower costs are only part of the story.

On-the-job accidents have dropped sharply. Drivers stay fresher, more alert because they now have no clutch pedal to push – quick-shift at full throttle with finger-tip hydraulic control—have only 3 shifts instead of 7 or 10.

Wet weather worries have almost disappeared—road maintenance costs are lower. Smooth power transmission by the Allison TORQMATIC DRIVES lets trucks drive through mud and muck—conditions that often shut down the mine before TORQMATIC-equipped units came on the job.

Big reason for lower operating and maintenance costs is shock-free power transmission by the *matched* TORQMATIC Converter-Transmission teams. The Converter absorbs shock loads instead of transmitting them along the drive line—protects engine, differential, drive shaft and transmission from damage.

There's an Allison TORQMATIC DRIVE for your 40- to 400-horsepower gasoline and Diesel equipment. New low-cost 40-150 h.p. TORQMATIC Converters easily fit present equipment, are completely self-contained for simple installation. Get full details about Allison TORQMATIC DRIVES from your equipment manufacturer or dealer or write:

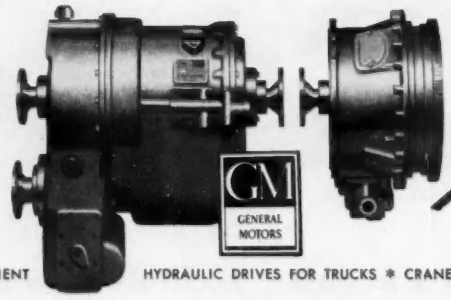
Allison Division of General Motors
Box 894S, Indianapolis 6, Indiana

ALLISON TORQMATIC DRIVES

Unbeatable Team for Maximum Operating Economy

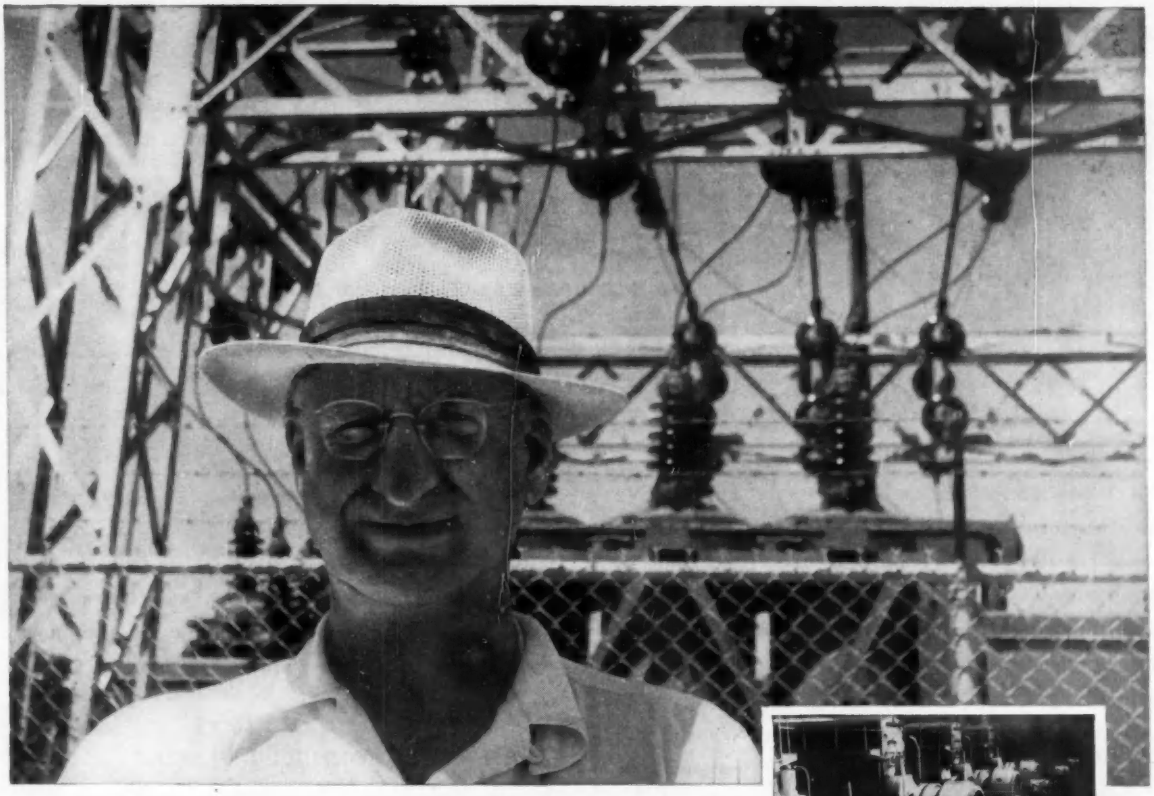
- **Quick-Shifts** at full throttle with finger-tip hydraulic control
- **Holds** power to load at all times – no clutch pedal to push—no gearshift guess
- **Reduces** maintenance costs by absorbing shock – eliminates engine lugging – prolongs equipment life
- **First** torque converter-transmission team designed to work as a *unit* and built by one manufacturer
- **Cuts** driver training costs

FIRST MATCHED UNITS BUILT BY ONE MANUFACTURER



Allison
TORQMATIC DRIVES

COMPACT, EFFICIENT HYDRAULIC DRIVES FOR TRUCKS * CRANES * TRACTORS * SCRAPERS * SHOVELS * DRILLING RIGS



POWERFUL GUY!

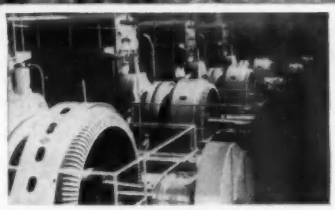
His four Nordberg Diesels, lubricated by Cities Service DC-940 Oil, supply six Oklahoma Counties with REA power. Have one of lowest cost-per-KWH records of entire REA.

His name's H. P. Wingo, and he's Chief Engineer of the REA plant operated by Western Farmers Electric Cooperative.

For the past four years, since his plant began operation in Woodward, Oklahoma, he's been responsible for a consistently high power efficiency rating, measured in cost per kilowatt hour...as high as fifth among all 42 REA plants! To maintain this record, he's had important help... help from four 1100 KW Nordberg dual-fuel engines...and help from Cities Service DC-940 Oil.

"Our engine compressions are the same today as they were after the first three months' operation," says Wingo. "In addition, using Cities Service DC-940, rings have remained absolutely free, liners have worn less than .0015, and we average 14,000 horsepower hours per gallon of oil. Filter elements last up to 1,500 hours."

Wingo has added his words of praise to those of scores of other users of Cities Service Lubricants. Summed up, these reports clearly demonstrate that superior performance is not the exception, but the rule, with Cities Service products. Your Cities Service Lubrication Engineer can readily explain why. Talk it over with him. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.



4 NORDBERGS, 4 YEARS OLD... yet engine compression remains the same as after first three months of operation at Western Electric REA Plant, Woodward, Okla. Rings "absolutely free," liners worn less than .0015, oil consumption at 14,000 H.P. hrs. per gallon using Cities Service DC-940 Oil.

CLOSE CHECK is kept on entire operation. Meanwhile, Cities Service Lubrication checks wear in Nordberg engines, helps engineer Wingo maintain record of low cost electricity. Supplying economical power to six Oklahoma Counties, plant's power efficiency rating has been as high as 5th in entire REA.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

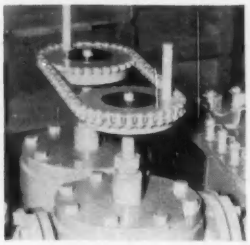
Random Thoughts from a Filter Engineer

by Harold R. Sobeck

- **GEORGE COULDN'T DO IT SO WE DID!**
- **PIGGY-BACK SOLUTION TO A SPACE PROBLEM**
- **GOOD OLD DAYS EVEN SOUNDED DIFFERENT**

GEORGE COULDN'T DO IT SO WE DID!

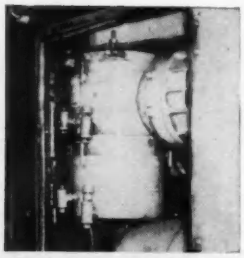
Sometimes a manufacturer has to step into another field to get the quality he wants in his product. So it was with our engineering staff when it stepped into the highly specialized valve-making field. We needed a special valve for our large duplex lube oil filter. But none of the valve manufacturers we knew were able to come up with one that would give satisfactory performance at a reasonable price. So we designed and made one of our own. We tried to let George do it, but he couldn't. The valve our engineering department designed shuts easily, evenly, with no leaks. And since it costs much less, we're able to pass the savings along to you. We don't intend to go into the valve-making business but we are glad we have engineers of our own who are versatile enough to step into a specialized field and find a solution that many specialists couldn't.



New Valve for Duplex Lube Oil Filter

PIGGY-BACK SOLUTION TO A SPACE PROBLEM

More and more railroads are switching to our oil bath filters for diesel locomotives. And with gratifying results. In a year's time, they can save the entire cost of the filter. But some types of locomotives couldn't be changed over. They just didn't have the space to allow for the use of an Air-Maze oil bath filter. Switchers, for example.



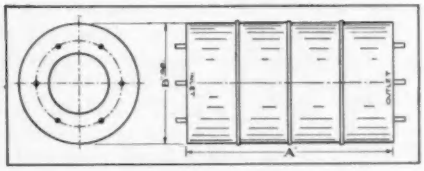
Typical Piggy-Back Filter Installation

That's when our engineers came up with a simple but ingenious arrangement of filters that saved the day. By putting one filter on top of the other, piggy-back style (see picture), a large air flow can be handled in a small space. So today even switchers can take full advantage of the benefits of Air-Maze oil bath filters.

GOOD OLD DAYS EVEN SOUNDED DIFFERENT

Today's engines even *sound* different than those of a few years ago. And that means different problems for the manufacturer of silencers. For example, modern turbo and super-charged engines draw in such a large volume of air at such high speeds that high frequency noise results. Ordinary silencers can't dampen this noise.

Air-Maze Inline Silencer used on Lobe Type Blowers



Our engineers met the problem by designing a new kind of silencer. Besides an acoustical chamber for dampening low and medium frequency noise, it has special materials that absorb high frequency noise as well. And this silencer can be used in-the-line, with or without oil-bath and oil-wetted filters. The Air-Maze Corporation, 25000 Miles Avenue, Cleveland 28, Ohio.

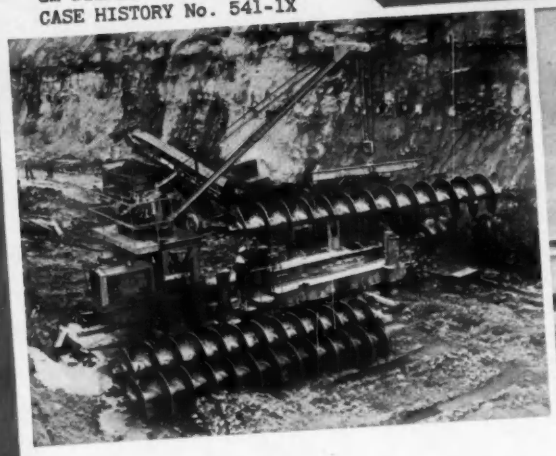
AFI MEMBER AIR FILTER INSTITUTE

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

GM DIESEL
CASE HISTORY No. 541-1X



OWNER: Peel Tree Mine, Clarksburg, W. Va.

INSTALLATION: GM "4-71" Diesel powers 42" McCarthy Coal Recovery Drill built by Salem Tool Company, Salem, Ohio.

PERFORMANCE: Mines up to 500 tons coal per day with 3-man crew. Works 9 to 11 hours per day drilling 170-foot holes 42" in diameter.

It Pays to STANDARDIZE on

. . . available in more than 750 models of equipment built by over 150 manufacturers

GM
GENERAL MOTORS
DIESEL POWER

MINES 500 TONS PER DAY
with GM Diesel Power

Quick-acting General Motors 2-cycle Diesel power speeds production and cuts costs in every kind of mining operation.

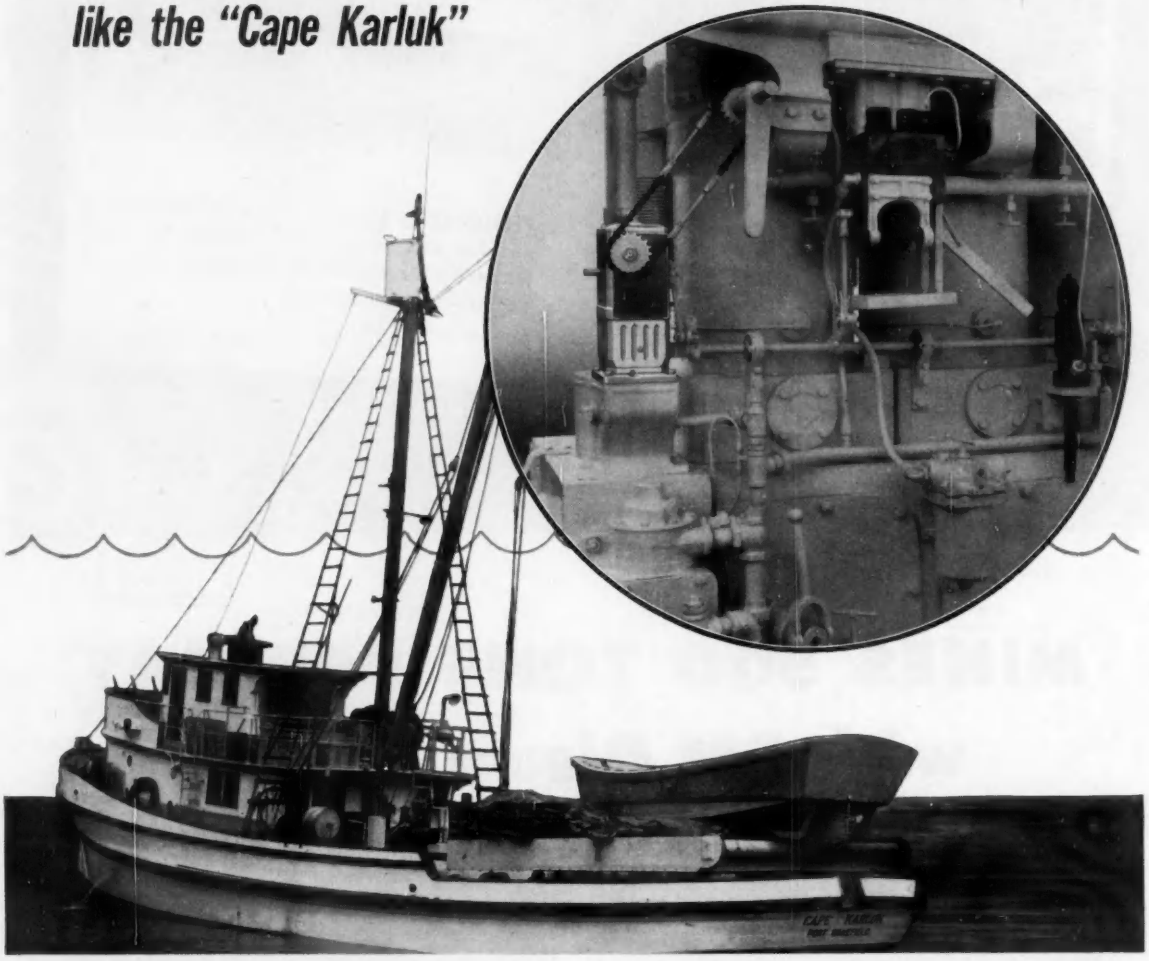
With power at every piston downstroke from 2-cycle operation, a GM Diesel accelerates faster, responds to controls quicker. It fits where other Diesels won't in many kinds of mining equipment because it packs more power into a smaller, lighter engine. Clean simple design makes maintenance easy, speeds servicing. And when parts are needed, GM Diesel distributors give quick delivery at low cost.

Call in your GM Diesel distributor for full details on GM Diesel power for your mine. And before you buy a Diesel, check parts costs, too. For example, GM Diesel cylinder liners cost up to 40% *less* than liners for other Diesels of comparable power. That's one reason why GM Diesels cost less to buy and less to maintain than other Diesel engines.

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN
Single Engines... 30 to 300 H.P. Multiple Units... Up to 893 H.P.

Marquette
HYDRAULIC GOVERNORS

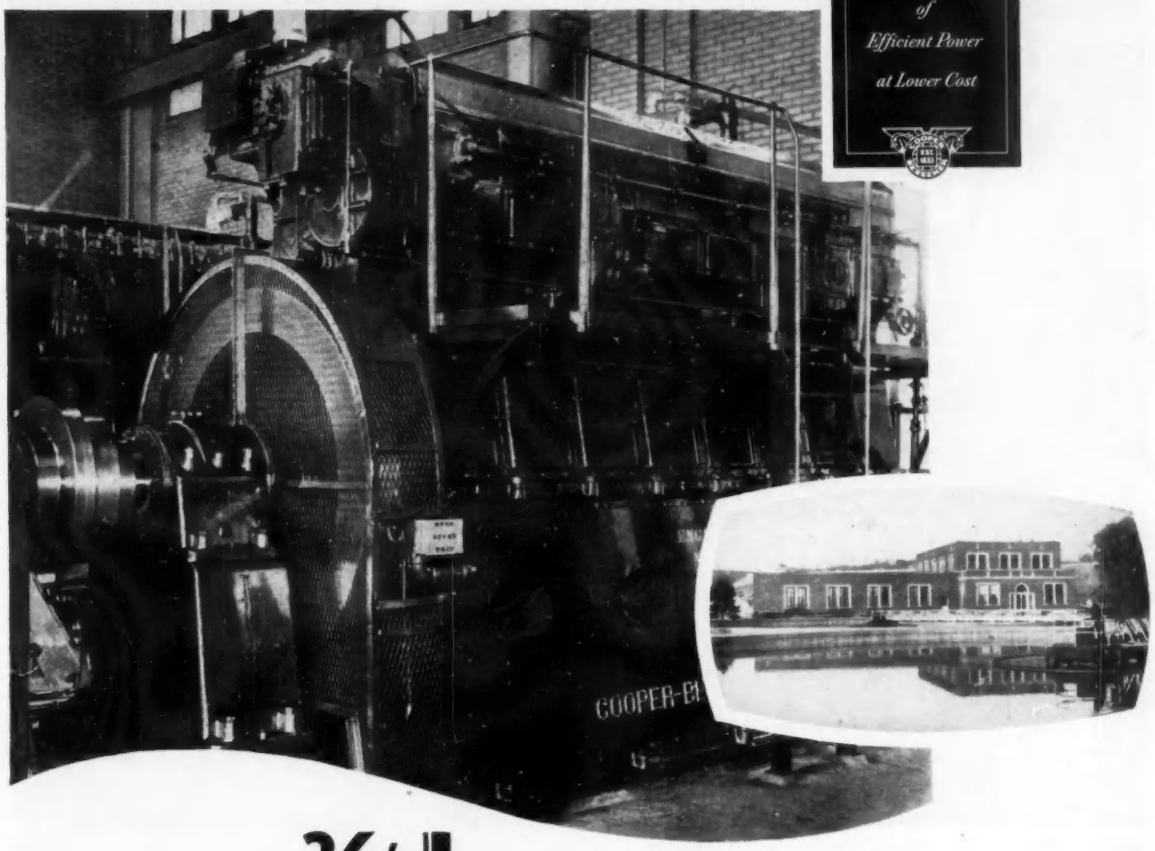
regulate the Union Diesel engines in many fishing boats like the "Cape Karluk"



The Marquette
METAL PRODUCTS CO.
CLEVELAND 10, OHIO
SUBSIDIARY OF CURTISS-WRIGHT CORPORATION

Also Manufacturers of:
ROLLER BEARING TEXTILE SPINDLES
WINDSHIELD WIPERS FOR AIRCRAFT
FUEL OIL PUMPS AND INJECTORS
PRECISION PARTS AND ASSEMBLIES
ROTARY HIGH PRESSURE OIL FIELD PUMPING MACHINERY

Another Example of Efficient Power at Lower Cost



36¢ PER HORSEPOWER PER YEAR!

... that's the maintenance score at Cleveland Southerly Sewage Plant with Cooper-Bessemers on the job!

•In most anybody's book, maintenance cost is a key to overall engine performance and economy. So take a look at the record of the two Cooper-Bessemer 420 hp gas engines serving Cleveland Southerly . . .

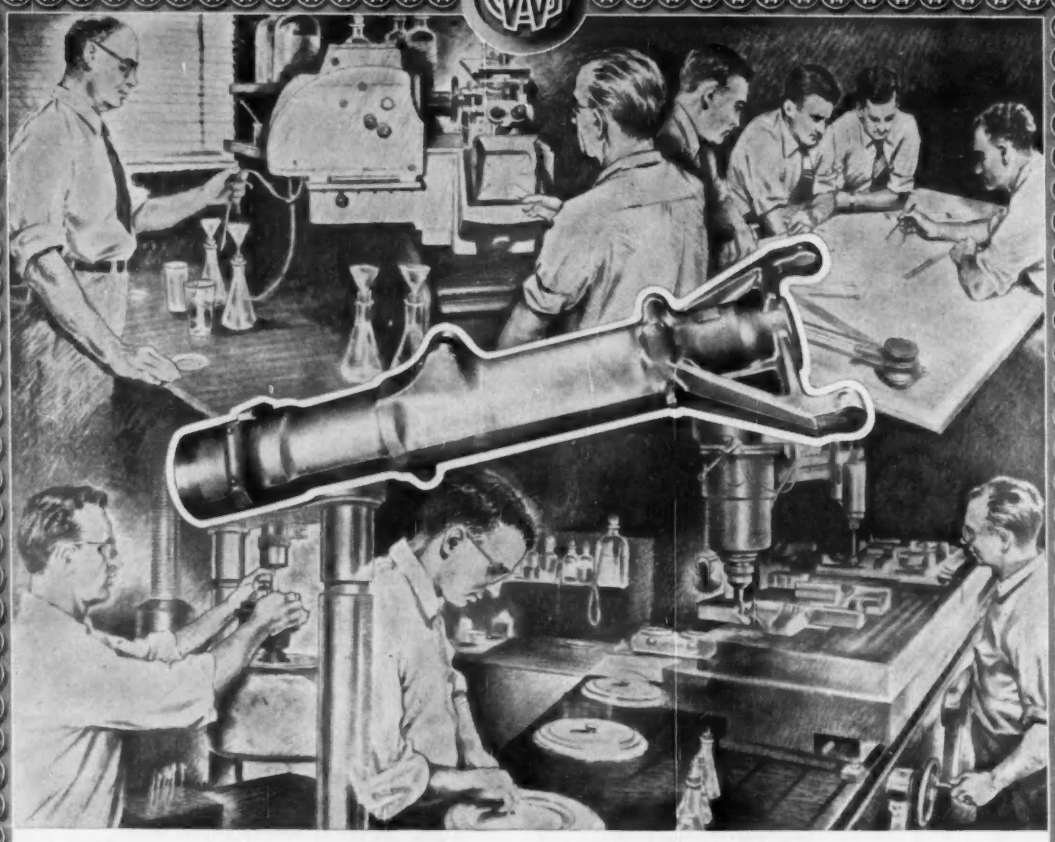
These units, driving blowers, run on untreated digestion gas. In all 16 years of their service, they have cost Cleveland only 36 cents per horsepower per year for replacement parts.

Today you'll find this same kind of service engineered into the latest Cooper-Bessemer gas engines, diesels and gas-diesels — along with fuel, lube and space economies never before equalled! Get all the facts.

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. New Orleans, La.



FORGING TECHNICIANS—Yes, that is the compliment paid us by those acquainted with our services. In back of each design is a thorough understanding of engineering and metallurgical needs before production begins . . . assuring forgings of maximum physical properties and uniform quality

THE LANDING GEAR FORGING illustrated, nearly five feet long, is an important component for a modern military fighter . . . another example of Wyman-Gordon's technical contribution to aircraft.

There is no substitute for Wyman-Gordon experience

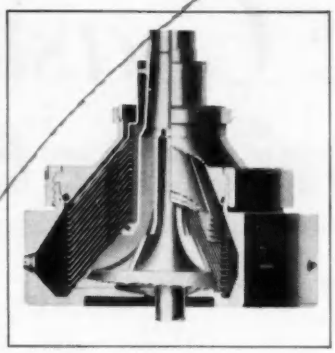
WYMAN-GORDON

Established 1883

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM

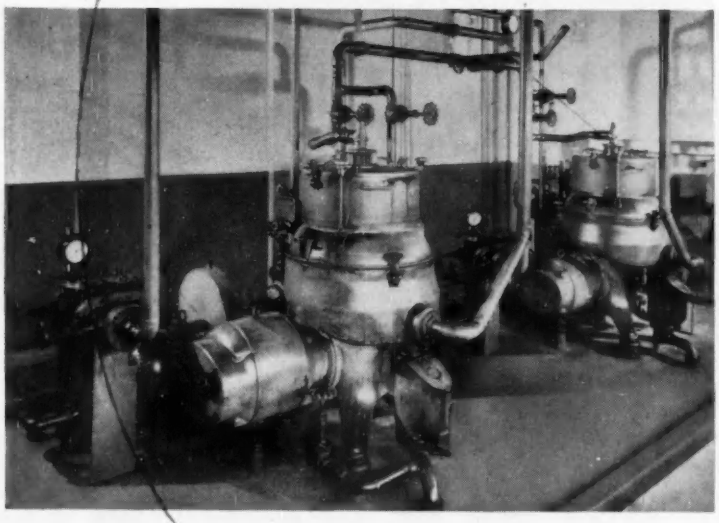
WORCESTER, MASSACHUSETTS

HARVEY, ILLINOIS DETROIT, MICHIGAN



De Laval "Nozzle-Matic" Bowl —first to be used on heavy fuel—Automatically Discharges Solids.

IF YOU CAN PUMP IT, WE CAN PURIFY IT... CONTINUOUSLY!



Right now De Laval "Nozzle-Matic" Heavy Oil Purifiers are giving operators of large diesel plants all the savings inherent in low-cost residuals by successfully handling oils with viscosities up to 6000 SSU at 100°F.

Equally important, the De Laval "Nozzle-Matic" not only purifies maximum viscosity fuel at 600 gallons per hour . . . but purifies *continuously—regardless of the amount of solids present in the fuel!*

Requires practically no attention . . . only the most infrequent shut-downs for cleaning . . . assures maximum ash removal with continuous discharge of separated solids.

Results: Greatest fuel economy . . . lowest maintenance costs.

Get complete details . . . now!

DE LAVAL
heavy oil purifiers

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • **DE LAVAL PACIFIC CO.** 61 Beale St., San Francisco 5

Atlantic Coast Line
lubricated with
speed perishable products

Diesels
Gulf Dieselmotive Oil

non-stop to markets

Atlantic Coast Line freights whisk all kinds of perishable vegetables from Florida to Northern markets on a non-stop schedule. Every precaution is taken to insure rapid delivery of these important perishables.

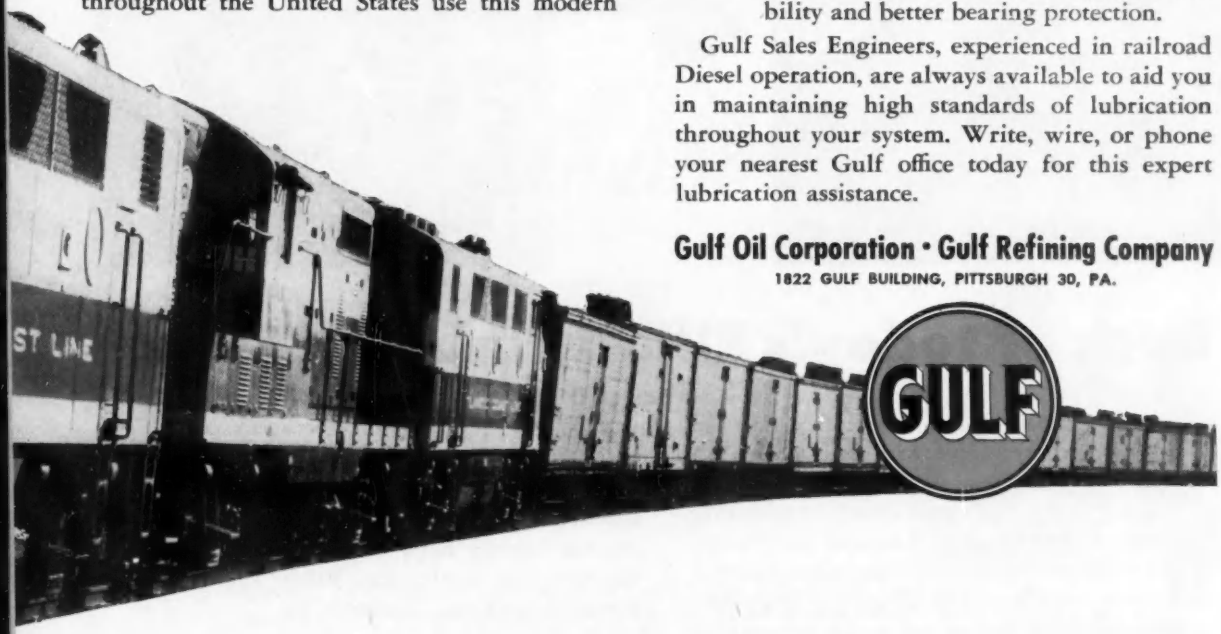
To insure dependable and economical operation, Gulf Dieselmotive Oil was selected to lubricate the powerful Diesel locomotives that roll these important freights through on exacting schedules.

Many other Diesel units on crack trains throughout the United States use this modern Diesel lubricant that contributes to better performance, greater availability, and lower maintenance costs.

Here's why:

1. Effective detergent action prevents harmful piston ring belt deposits.
2. Base stocks are selected for their ability to help prevent hard deposits on the piston crown and in the ring belt area.
3. 100% solvent refining (removing undesirable constituents) insures greater stability and better bearing protection.

Gulf Sales Engineers, experienced in railroad Diesel operation, are always available to aid you in maintaining high standards of lubrication throughout your system. Write, wire, or phone your nearest Gulf office today for this expert lubrication assistance.

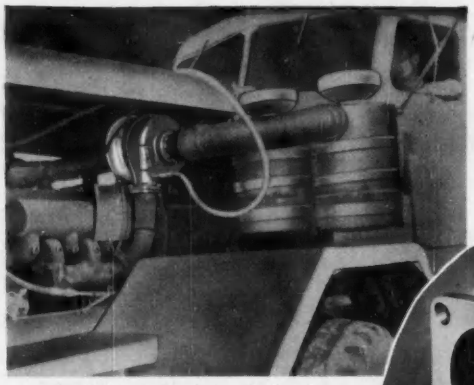


Gulf Oil Corporation • Gulf Refining Company

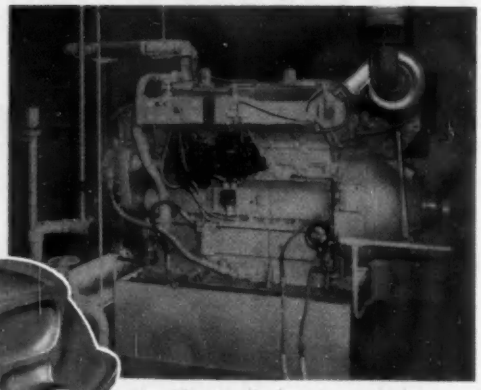
1822 GULF BUILDING, PITTSBURGH 30, PA.

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

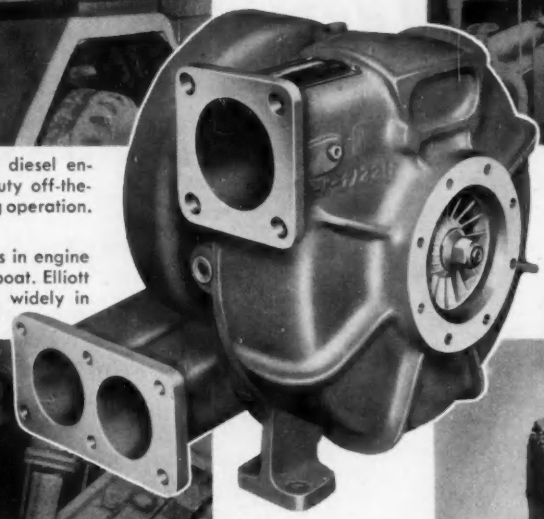
You can count on ELLIOTT turbocharging!



An Elliott turbocharged diesel engine used in a heavy-duty off-the-highway truck in a mining operation.

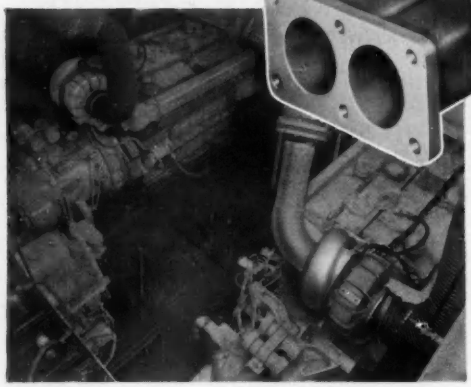


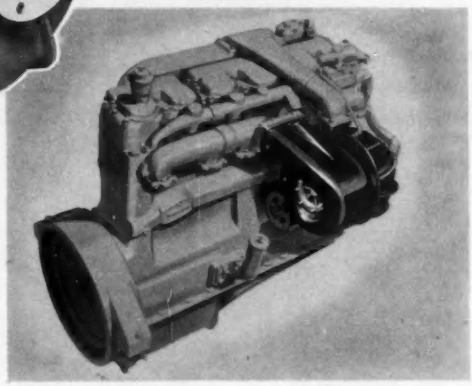
An Elliott turbocharger applied to a diesel engine in an industrial pumping installation.



Two Elliott turbochargers in engine room of a powerful towboat. Elliott turbochargers are used widely in marine service.

Elliott turbochargers also boost output of high-speed engines like this for truck, marine, locomotive and stationary plants.



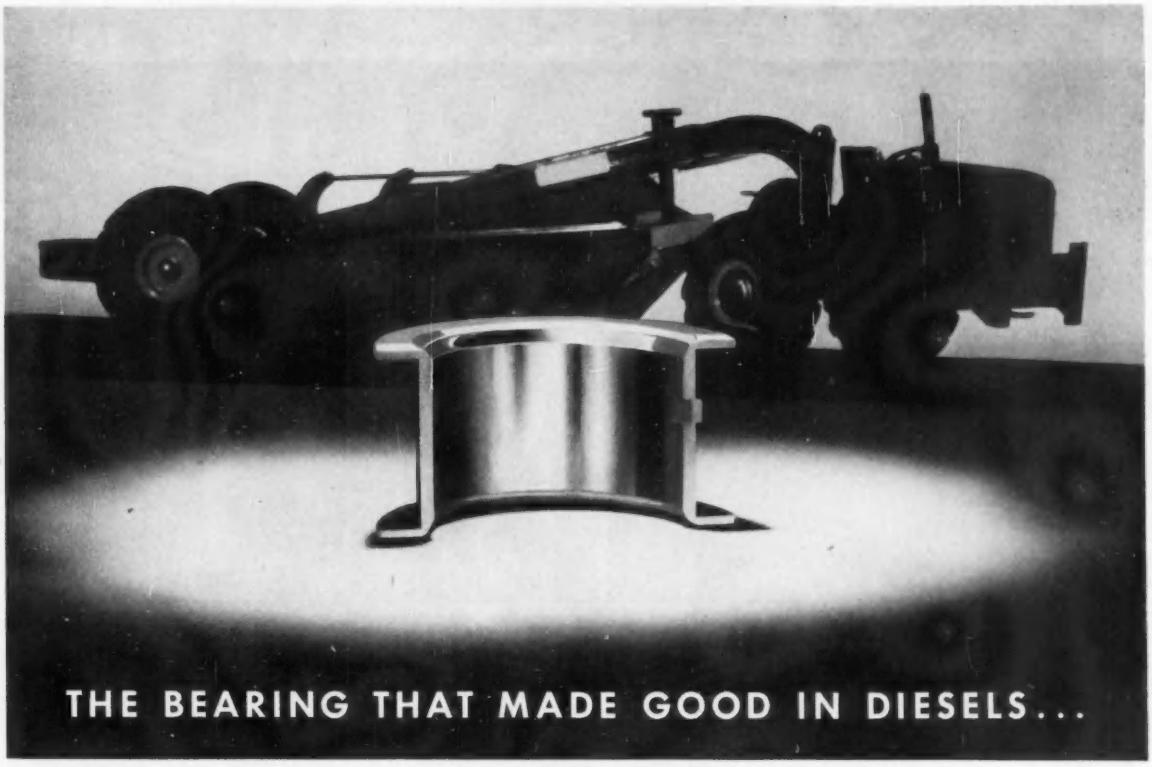


Back of today's Elliott turbochargers...

. . . are 15 years of design, manufacturing and application experience with over 12,000,000 hp of turbocharged engines! These turbochargers are piling up thousands of operating hours on the toughest kinds of service—on heavy-duty on-and-off-highway trucks, railroad locomotives, oil-well drilling rigs, drag lines, power shovels, marine and stationary installations. When your diesel engine is equipped with an Elliott turbocharger you can count on it to deliver the trouble-free performance and high operating standards required.

Get full information on Elliott exhaust-driven turbochargers for four-cycle or two-cycle engines. Specify them on your next engine, whatever the application. Elliott Company, Supercharger Dept., Jeannette, Pa.

ELLIOTT Company



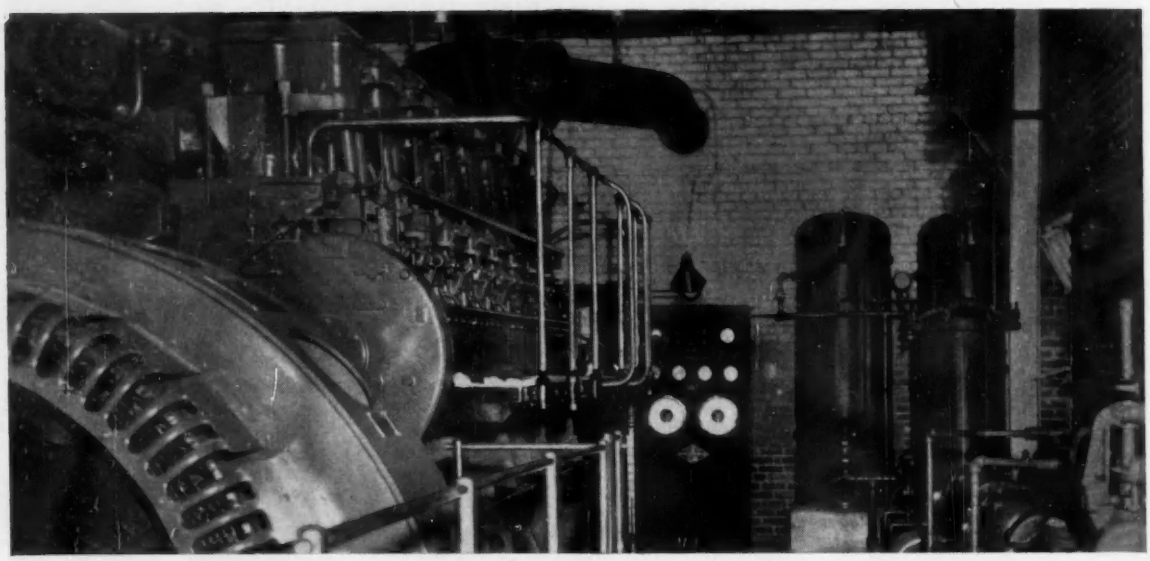
JOHNSON Aluminum on Steel

Right here has been developed the greatest sleeve bearing in years—Johnson Aluminum-on-Steel. This patented combination of metals is especially suited to take the heavy loads and shocks required of much diesel power. The physical properties of aluminum bonded to steel assure long, trouble-free service. Write for full information.

JOHNSON BRONZE COMPANY • 470 South Mill Street, New Castle, Pa.

JOHNSON JB BEARINGS
Sleeve-Type

Count on Johnson

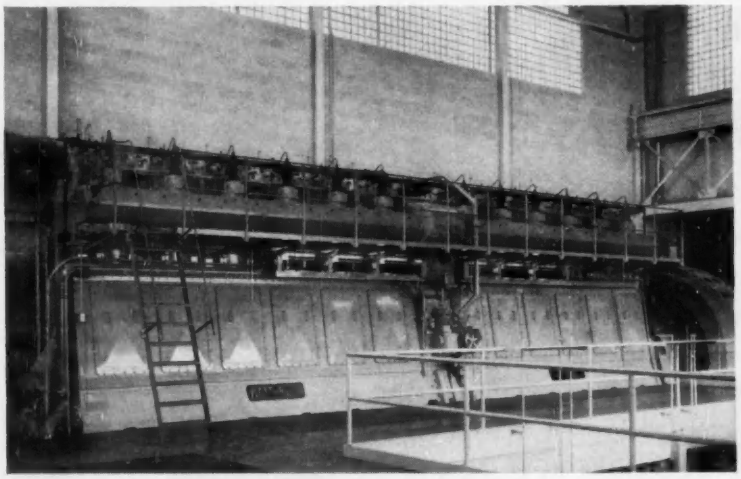


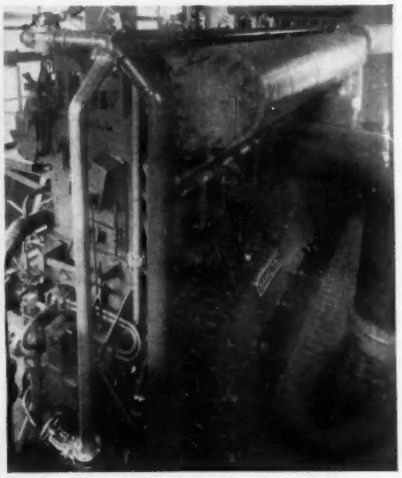
BALDWIN

600 SERIES

12¾ x 15½ turbocharged diesels with 6 or 8 cylinders. Develop 620 to 1750 hp at 514 to 625 rpm.

QUAKERTOWN, PA., switched to diesel power generation with this 1560 hp Baldwin and saved three ways . . . (1) Initial cost was appreciably less than alternative boiler and turbine. (2) Medium speed (600 rpm) Baldwin is very economical in use of fuel and lube oil. Total operating costs, including amortization, are 60% less than purchased power. (3) Ready availability of the Baldwin for standby service has cut weekend operating costs 25%.





HAMILTON

21½ x 27½

diesel and dual fuel engines. Available in 5 to 12 cylinders with a net horsepower range from 2350 to 5450.

WRITE for more facts about these B-L-H diesels that are your most economical and dependable power generating source in the 500 to 20,000 kw range.

DECATUR, IND. (Heavy Fuel) This 3810 kw Hamilton 21½ x 27½ engine operates 18 to 20 hours daily burning heaviest residuals with an *absolutely invisible exhaust*. There's been no unusual piston ring or liner wear. Decatur's fuel cost is just 4.6 mills per kwh.

ROBSTOWN, TEX. (Dual Fuel) This 2050 kw Hamilton 21½ x 27½ engine has been performing efficiently on dual fuel since 1952. Equally high efficiency is reported for two newer, 9 cylinder, Hamilton dual fuel engines like this at Great Bend, Kansas.

BALDWIN-LIMA-HAMILTON

Hamilton Division, Hamilton, Ohio

The Engineer's Report

CASE HISTORY

LUBRICANT RPM Delo Oils

FIRM Greyhound

Greyhound's new Scenicruisers use RPM DELO Oils!

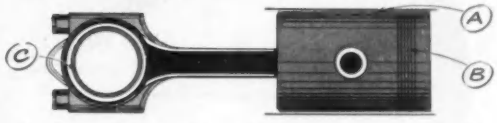
$49,000 WORTH OF HIGHWAY LUXURY—that's Greyhound's new Scenicruiser. Five hundred of these 43-passenger luxury coaches are going into service on through routes. These twin diesel power units, as well as other Greyhound buses in the West, use RPM DELO Oils—chosen by Greyhound because of its years of outstanding performance with these quality oils. Power from the two side-by-side 150 h.p. diesels for each coach goes through two fluid couplings and a multi-speed transmission to the forward axle of the tandem rear unit; rear axle rides free. Each coach has captive air suspension, power brakes, power steering and air conditioning, and will operate on either engine.

FOR MORE INFORMATION about petroleum products of any kind or the name of your distributor, write or call any of the companies listed below.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U. S. PAT. OFF.

How RPM DELO Oils reduce corrosion, wear, oxidation in all heavy-duty engines



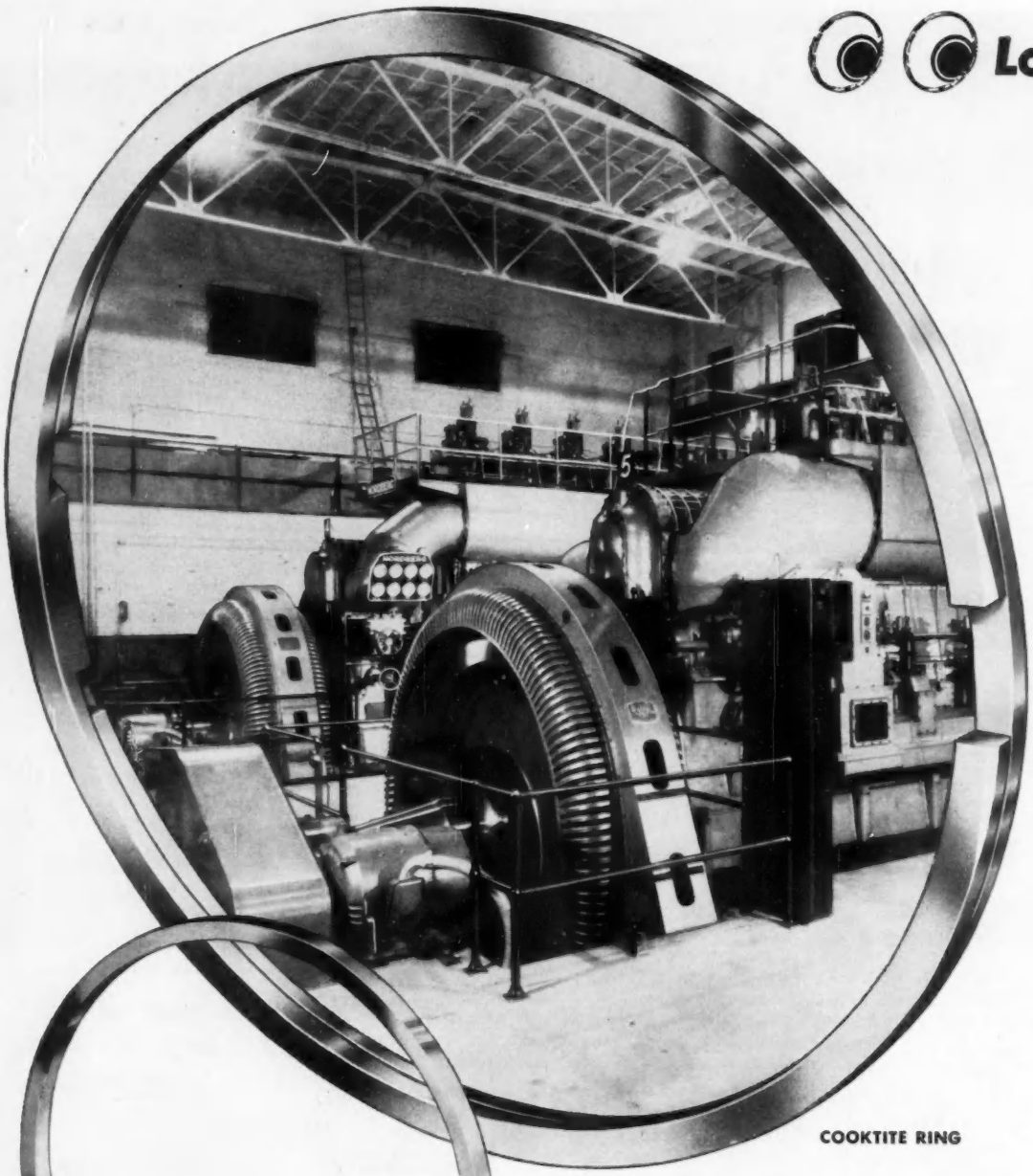
A. Contain special additives that provide metal-adhesion qualities...protect parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring sticking. Detergent keeps parts clean...helps prevent piston scuffing.

C. Special compounds stop corrosion of any bearing metal and foaming in crankcase.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

Look



COOKTITE RING

TYPE 101 RING

RE-TURNING MAKES BETTER RINGS!

Because they are re-turned as a final manufacturing process, Cook Piston Rings are light-tight, and conform perfectly to the cylinder wall. This eliminates the possibility of scuffing during initial operation. The perfect conformity of re-turned Cook Rings prevents hot gases from blowing by and impairing lubrication when it is needed most. The result — *longer life and — more efficient performance!*

to COOK for Better Rings!

372.2% More Operating Time Between Ring Renewals!

That's Bryan, Ohio's Experience With Cook Piston Rings!

THE 3600 HP Diesel engines on the opposite page are two of several large-bore units generating electricity for a municipal power plant — the Bryan Light & Water Works, Bryan, Ohio. Altogether there are four engines, totalling 9600 HP.

Before being equipped with Cook Plain and Cooktite Sealing Rings, these engines had been averaging only about 1750 operating hours between complete ring renewals. But look what happened under similar operating conditions, when Cook Piston Rings were installed. *Compare operating hours, cylinder wear and ring breakage — "before and after"!*

As you'd expect, this operator has now standardized on Cook Rings, exclusively, for all four engines!

If you're looking for a seal with the savings built in, mail the coupon today for product information, and the name of your nearest Cook representative.

	FORMER RINGS	COOK RINGS	% CHANGE
Average Operating Time Per Piston Pulling For Ring Inspection	1750 Hours	3500 Hours	+100.0%
Average Operating Time Between Complete Ring Renewals	1750 Hours	8265 Hours	+372.2%
Maximum Average Cylinder Wear Per 1000 Operating Hours	.0065"	.0031"	− 52.3%
Average Number of Broken Rings, Per Engine Set	9 Per 1750 Operating Hours	1½ Per 6500 Operating Hours	− 95.5%

C. LEE COOK COMPANY

Sealing Pressures Since 1888

C. Lee Cook Co.
964 South 8th Street
Louisville 3, Kentucky

Gentlemen: Please send me complete information on Cook Piston Rings and name of nearest representative.

Firm _____

Street _____

City _____ State _____

Attention _____

Type of Units _____

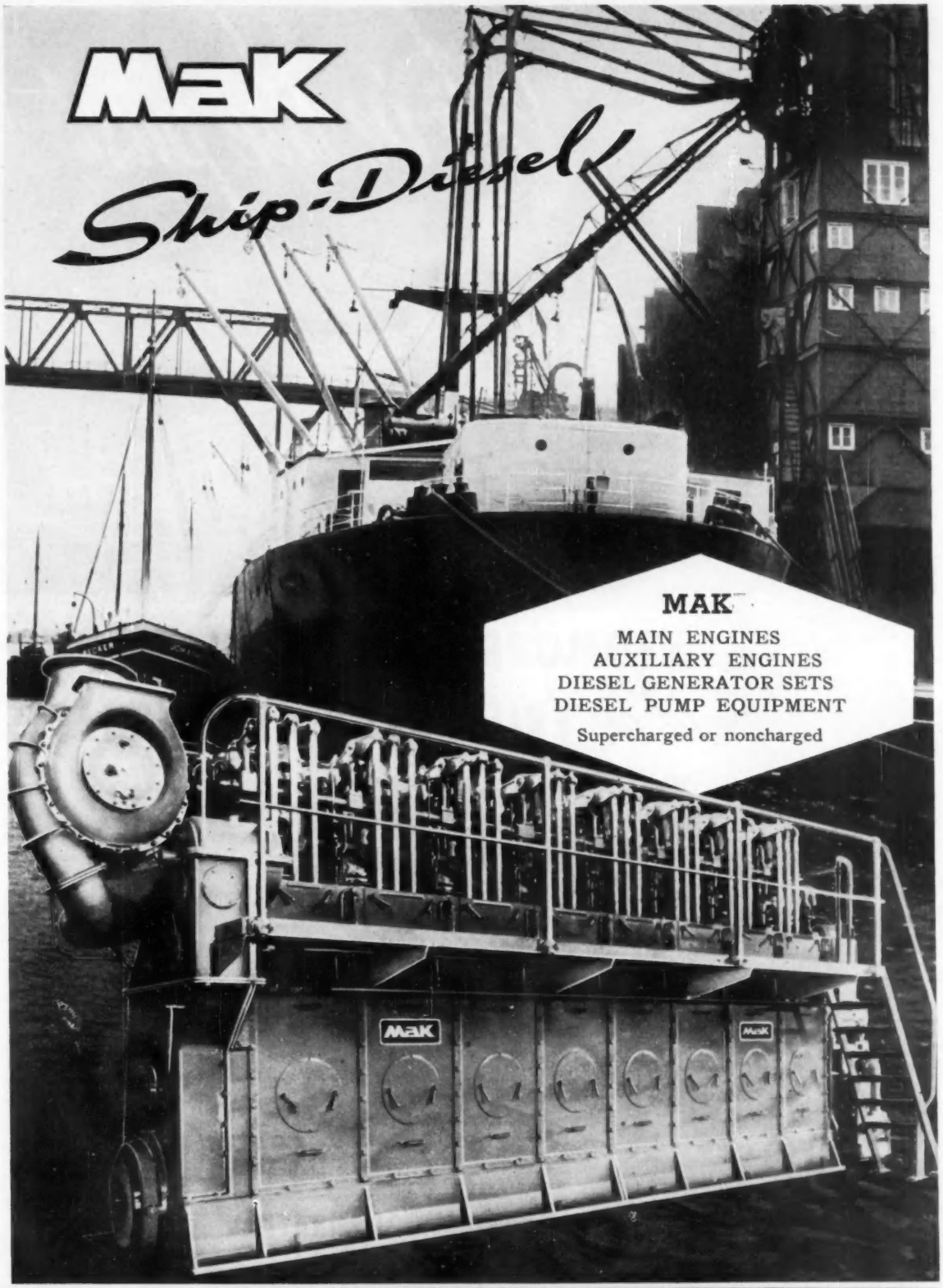
EATON
Valves and Bolts
FOR DIESEL ENGINES

Eaton Diesel engine parts combine the experience of many years as suppliers to the Diesel engine industry with the most modern precision production facilities—plus a thorough understanding of the problems peculiar to the Diesel engine field.

Eaton engineers will welcome the opportunity to discuss the application of Eaton Valves and Bolts to your engines.

EATON VALVE DIVISION
MANUFACTURING COMPANY
9771 FRENCH ROAD • DETROIT 13, MICHIGAN
General Offices: CLEVELAND, OHIO

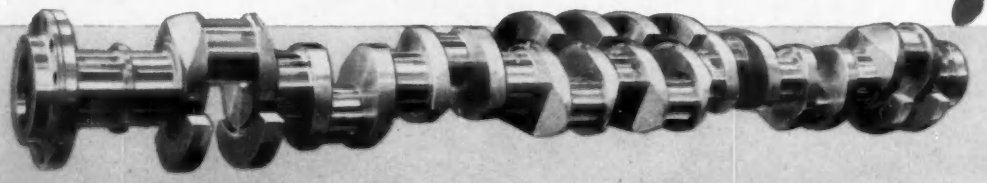
PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers



MASCHINENBAU KIEL AKTIENGESELLSCHAFT

GERMANY

TOMORROW'S DIESELS
Will depend on ERIE FORGE CRANKSHAFTS!



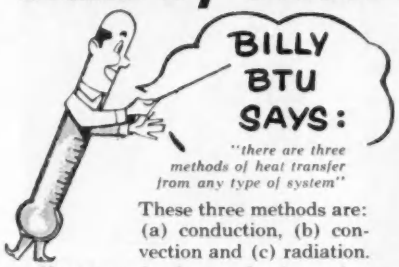
PRECISELY machined Erie Forge Crankshafts have, for many years, been synonomous with highest quality workmanship. At Erie Forge & Steel Corporation every step in production—from ingot to finished crankshaft, is under one control, one supervision. Every operation falls under closest scrutiny, thus assuring perfection in material specification, forging, machining and finishing. Today's diesels for industry, ships and locomotives depend on Erie Forge Crankshafts. Diesel engines of tomorrow will, too, because Erie Forge & Steel Corporation produces the finest forging you can buy.

ERIE FORGE & STEEL CORPORATION
ERIE, PENNSYLVANIA

Young Heat Transfer News

YOUNG RADIATOR COMPANY, RACINE, WIS.

Oak Ridge Atomic Energy Plant Installs Stand-By Diesel Power Plant . . . *YOUNG Cooled!*



These three methods are: (a) conduction, (b) convection and (c) radiation.

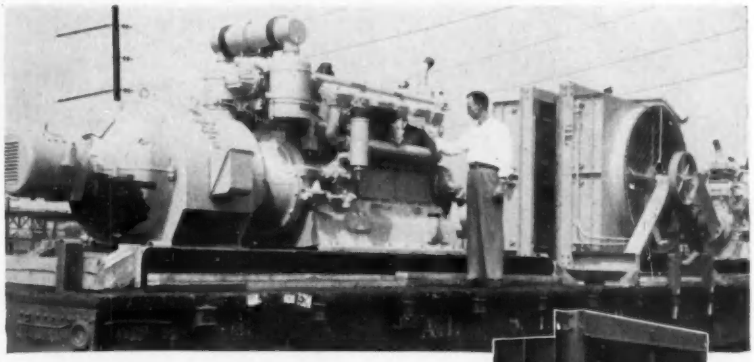
Heat transfer by conduction exists when heat flows within a body from one region of high temperature to another region of lower temperature by simple molecular communication. The amount of heat which can be transferred by conduction is dependent on the temperature difference, thermal conductivity of the material through which the heat is being conducted, the distance between the hot source and the cold sink, and the cross sectional area for heat flow.

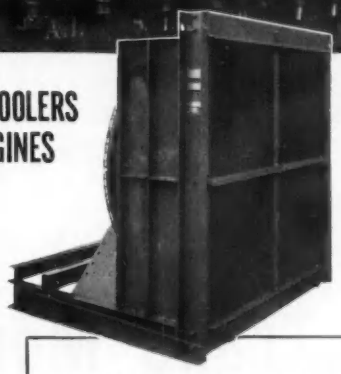
Transfer of heat by forced convection depends on the velocity of the fluids over the surface through which heat is conducted . . . by the shape of the surface, by the area through which heat is conducted . . . and by various properties of the fluid as well as temperature difference.

The third general means of heat transfer is radiation. Here heat flows from the body of the higher temperature to the body of the lower temperature through space without any medium within the space. For further details on this subject write for free bulletin: "Heat: Forced Convection Removal From Industrial Hydraulic Circuits" to Young Radiator Company, Dept. 415-C Racine, Wis.

New TYPE "F" Heat Exchanger Catalog Ready

A complete description of stock and specially engineered Young Radiator Company Type "F" Fixed Tube Bundle Heat Exchangers is given in the newly revised Catalog No. 1245. For your copy, write Dept. 415-C Young Radiator Company, Racine, Wis.





Top: Caterpillar D397 Electric Set on flatcar.

Bottom: Young Radiator Company "Mono-Weld" Cooler.

YOUNG TWIN JACKET WATER COOLERS SPECIFIED FOR 500 H.P. ENGINES

Stand-by power sets driven by four new Caterpillar diesel engines are equipped with Young-built "Mono-Weld" Radiators used to cool engine jacket water at Oak Ridge, Tennessee, atomic energy power plant. These emergency units may be called for supplying power for critical instrumentation and controls . . . delivering 300 kw in 10 seconds after a power failure!

The four new Caterpillar D397 engines shown above at the Peoria plant will be added to the ten other previously installed Caterpillars for the standby facilities.

These rugged Young Radiator Company "Mono-Weld" Radiators maintain optimum engine jacket water temperatures under all load conditions. Improved "Mono-Weld" features include heavy steel channel design, increased rows of tubes, deeper plenum chamber, highly efficient fan rings and other engineering advantages.

"Mono-Weld" Radiators are available in capacities from 210,000 to 2,970,000 Btu/hr., for economical jacket water cooling for gas, gasoline and diesel engines. Write today to Dept. 415-C for complete information.

Young RADIATOR COMPANY

RACINE, WISCONSIN

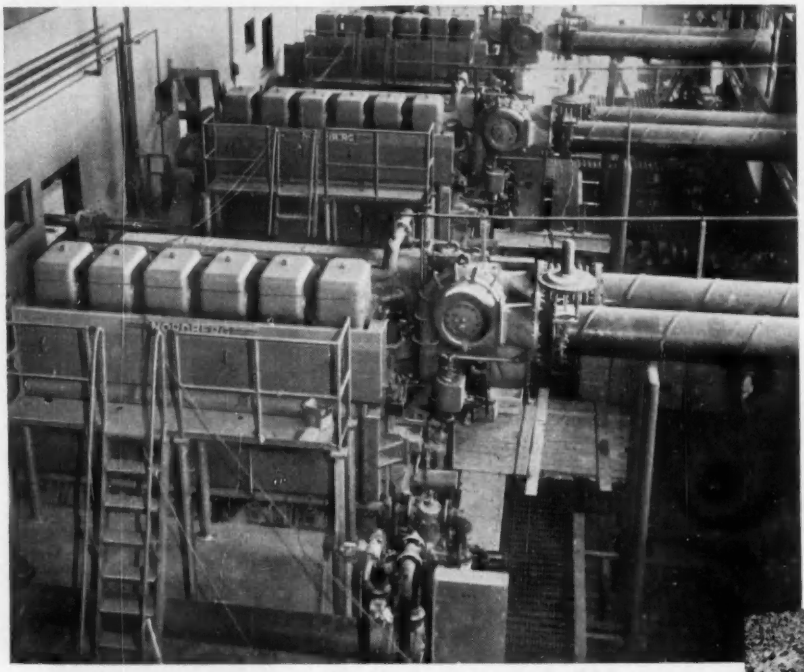
Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

Pipeline with concrete weight applied at approach to crossing of the Fraser River.

Steep going on this mountain section of the pipeline.



Norberg engines at the Edson, Alberta, station are rated 1320 H.P. at 500 R.P.M.

Gate valve installed 40 miles west of Edmonton.

Trans Mountain Pipeline opens new Canadian oil markets

The Trans Mountain pipeline carrying oil from Edmonton, Alberta, over 718 miles of rough terrain to Vancouver, B. C., is rightly considered one of Canada's foremost industrial developments. This impressive engineering achievement now links the oil fields of the prairie provinces with the fast growing industry of the Canadian Pacific Coast.

In the four pumping stations along the line, nine 8-cylinder and three 6-cylinder Nordberg Diesel engines with Bendix* Fuel Injection Equipment keep up the constant flow of this vital oil supply.

On the tough jobs, as well as routine tasks, Bendix Fuel Injection Equipment is the logical choice for dependable performance.

*REG. U.S. PAT. OFF.

SCINTILLA DIVISION of
SIDNEY, NEW YORK

Bendix
AVIATION CORPORATION

___ hours of unproductive down time @ ___ per hour
___ hours of labor in the service shop @ ___ per hour
Lost revenue during bearing break-in
Business lost because truck was not available
(maybe lost forever to a competitor)
TOTAL

What does a bearing failure really cost?

• You'll have to supply your own figures.

And what can you do about such losses?

One way is to *prevent* them . . . by standardizing on the same bearings originally installed in most new engines—Clevite* 77.

Owners report mileages approaching 300,000 on a set of Clevite 77 bearings . . . and with little sign of wear on shafts. They report higher sustained speeds for faster, more profitable schedules.

Next time you tear down an engine, try a set of Clevite 77. You can get them from your nearby N.A.P.A. jobber.

*The words Monmouth, Clevite and Micro are registered trade marks of Clevite Corporation.

Monmouth

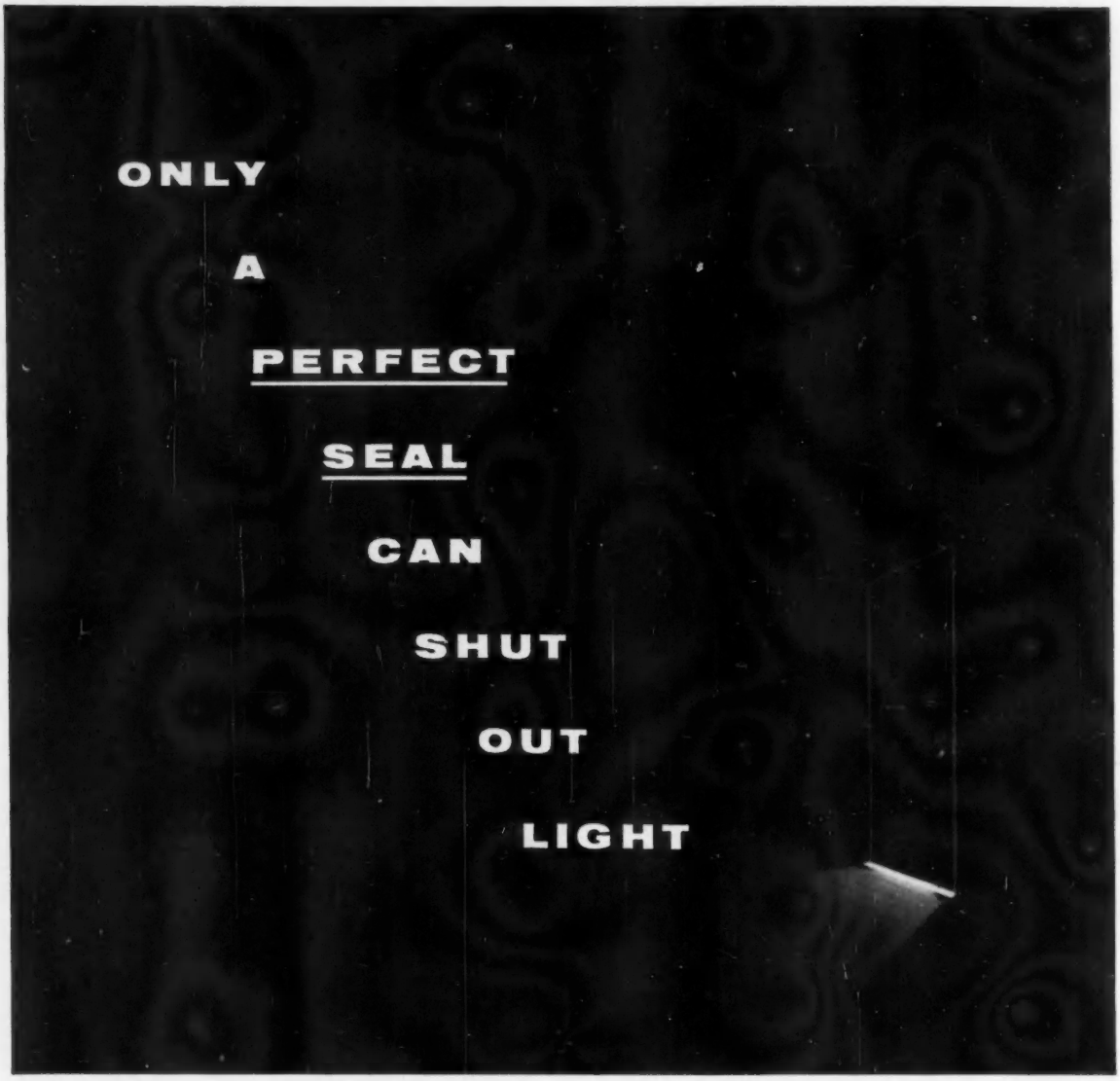
TRADE MARK

ENGINE BEARINGS

Clevite Service
The Cleveland Graphite Bronze Co.
Division of Clevite Corporation, Cleveland, Ohio, U. S. A.

NAPA Assurance of Quality

Your NAPA Jobber is a Good Man to Know!



PEDRICK PIONEERED "LIGHT-TIGHT" PISTON RINGS

In big-bore engines, "light-tight" piston rings have revolutionized standards of performance. As a result of Pedrick pioneering, engine operators and engine manufacturers now know that all piston rings must be really "light-tight" in the cylinder if they are to deliver uniformly good performance and long life.

A "light-tight" ring is one which is made with so much care and know-how that when it is placed in a gage of cylinder size with an intense light below, no *light* leaks past the face of the ring and the cylinder wall! This means a *perfect seal*, and that's what you need in a piston ring.

PEDRICK makes "light-tight" piston rings for big-bore engines . . . the result of an uncompromising standard of quality and precision workmanship which Pedrick artisans have maintained for more than 35 years.

So, whatever your requirements . . . single rings or Engineered Sets . . . for the BEST and MOST DEPENDABLE and LONGEST ring performance between engine overhauls, it will pay you to insist on PEDRICK light-tight, quick-sealing rings. Engineering service available also to help you with special problems. Write, wire or phone: WILKENING MANUFACTURING Co., Philadelphia 42. Saratoga 9-3770.

Pedrick PISTON RINGS

PEDRICK PRECISIONEERING KEEPS PEDRICK FIRST

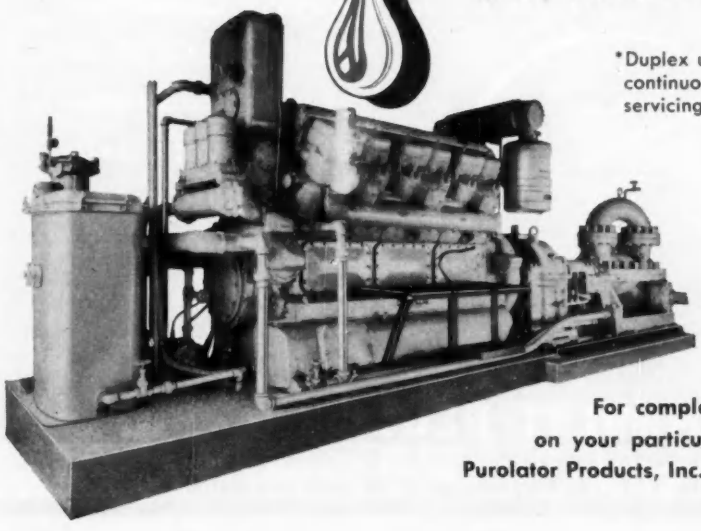
For positive filter protection . . .

CHECK THESE 5 POINTS WITH PUROLATOR

"FIRST in the field of filtering"

- **Full flow lubricant filtration**
- **Micronic filtration of fuel to the injector pump ***
- **Individual filter protection for each nozzle**
- **Metal edge filter to protect fuel transfer pump ***
- **Air intake filtration**

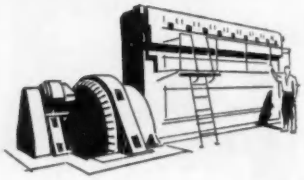
*Duplex units available for continuous operation while servicing filter elements.



For complete technical filter data on your particular diesel application, write to Purolator Products, Inc., Dept. DL1-311, Rahway, New Jersey.

SINCE 1864
DEUTZ
Diesel
3-2000 H.P. air and water-cooled for Road vehicles, Rail vehicles, Watercraft, Working machines · Marine engines also direct reversing for all waterways · Dieseltractors 11·15·22·30·45·60 H.P. Diesellocomotives · Generator sets air and water-cooled for lighting current and power stations stationary and mobile
KLÖCKNER-HUMBOLDT-DEUTZ AG · KÖLN

Address inquiries from U.S.A., Alaska, Hawaii and Puerto Rico to: DIESEL ENERGY CORPORATION, 82 Beaver Street, New York 5, N. Y. Certain territories open for distributors.



"Cured... bearing failure in their diesel-driven, front-end loaders"

A large fire-brick manufacturing company in the Philadelphia area had the problem of premature bearing failure in its diesel-driven loaders and shovel.

Headlights on even in daylight...

Sinclair Lubrication Engineer Harry Donovan reports, "These units were operating around the clock under conditions *so dusty that headlights were required.* Crankcases had to be drained and flushed bi-weekly! My first recommendation was closer adherence to an air filter maintenance program."

Drain intervals doubled!

Mr. Donovan continues, "Further observation proved to me that excessive idling and overloading were all contributing factors to a severe sludge condition. I recommended Sinclair SUPER TENOL® – explaining that the superior quality of the base oil plus the Sinclair formulated additives would extend bearing life *while at the same time removing accumulated lacquer and sludge.* A trial period proved SUPER TENOL doubled drain intervals and eliminated flushing entirely. This company now uses Sinclair SUPER TENOL exclusively."

Why not give a Sinclair Lubrication Engineer the chance to solve *your* lubrication problems? *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR LUBRICANTS

SOLVE vibration • movement • expansion problems

SIMPLIFY offset connections

REDUCE maintenance ... in diesel exhaust, air, oil and water piping

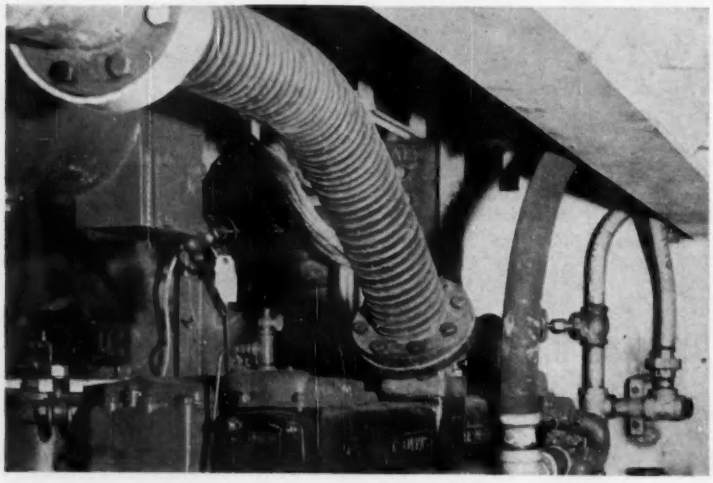
In diesel engine piping systems, American flexible metal hose offers a practical solution to problems of vibration and expansion, the principal reasons for accelerated failure of rigid pipe. It's simpler to install, too. You *bend* it into position, saving time on the job and making easy work of fitting offset connections.

For heavy-duty exhaust and air intake lines, specify American Flexible Steel Corrugated Hose. It adjusts to expansion and dampens engine vibration, preventing excessive stress on exhaust manifold flange bolts and fittings. Vibration dissipates in the hose and is not transmitted to adjacent structural members. Assemblies are supplied complete with floating flanges to simplify lining up with companion flanges.

To convey air, oil and water, use American Seamless Flexible Metal Tubing. Made in bronze or carbon steel for standard service, and in stainless steel or Monel for special service. Tubing has woven wire braid covering for added strength. Complete assemblies include fittings.

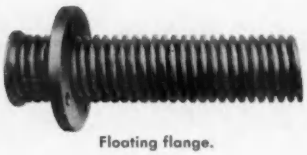
55199

Below: Flexible, corrugated steel hose carries hot diesel exhaust gases to atmosphere.

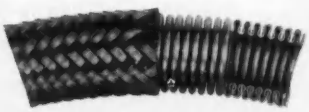


Type Y-10 flexible, corrugated exhaust hose assembly with floating flange, left, and fixed flange. ID's 2" through 16".

Type Y-10 hose with welded nipple, supplied with or without flange.



Floating flange.



Type S-1 braid-covered seamless flexible metal tubing for air, oil and water lines. Seamless tubing is 100% tight and extremely flexible. ID's ⅛" through 12". Usually furnished with fittings attached.

WANT MORE INFORMATION? Bulletin EH-50 gives detailed engineering data on American flexible metal hose and tubing for diesel engines. We'll be glad to send you a free copy, or have one of our sales engineers call. No obligation of course. Address *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn.* In Canada: *The Canadian Fairbanks-Morse Company Ltd.*

WHEREVER CONNECTORS MUST MOVE

AMERICAN

FLEXIBLE METAL HOSE AND TUBING

AN

ANACONDA®

PRODUCT

editorially speaking

Specifications Due for Workout

Come the second week in June, seismographs all over the country will probably record tremors emanating from Washington, D. C. The roof of the Statler Hotel may go sailing off into outer space at the same time. Don't be alarmed and head for your Little-Dandy Bomb Shelter. There will be no fallout unless some outmoded conceptions are shaken out of the trees. It will just be the irresistible force of our industry's advances meeting the immovable force of government engine specifications. Come to think of it, "immovable" might not be the right word. Some say they can't pin the specs down; sort of like trying to shoot a flying bat in a dark barn. Anyhow, these doings have been set up by the Oil and Gas Power Division, American Society of Mechanical Engineers, as part of their 1955 Annual Conference. The meeting's theme is to be "Oil and Gas Power for National Defense", with the military services, government agencies, and our industry participating. We've peeked under a corner of the tent, and it's going to be a really worthwhile show. The specification act is going on in the General Technical Committee meeting on Monday, June 6th, when everyone is fresh. It will be an open meeting with a panel of both industry and government people. But anyone can get into the act; the OGP wants it that way. Here's a chance to get your constructive ideas on the record. There will be other chances too. "Constructiveness" should be the keynote. The government uses a great number of engines, and it is in everyone's interest that they get the best. "Best" is conditional and subject to honest differences of opinion. The OGP is doing a real service in providing a forum where this vital matter can be discussed, openly and on the broadest possible front. A lot of good can come of it—if you attend and participate!

BPE

Cyclan

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- Combines the best characteristics of iron and steel.
- Equals or surpasses the wearing quality of cast iron.
- Approximates the strength of steel.
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- Stands up in super-charged engines.
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- Now used for original equipment in heavy-duty engines.
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highlights

- Summer General Meeting of the American Institute of Electrical Engineers will be held at Swampscott, Mass., from June 27 through July 1, 1955.

- Santa Fe Railway recently announced plans to build 150 new mechanical temperature-controlled refrigerator cars during 1955 at its West Wichita, Kansas shops. At present, the road has 30 of these cars in service.

- The Pennsylvania Railroad has ordered two new diesel-electric tugs for service in New York Harbor. This will bring the Pennsy's fleet of modern diesel-powered tugs to a total of 13.

- For the first time in trucking history, an automatic transmission is offered in every size truck by GMC from the light-duty models up to the heavy-duty, diesel-powered rigs.

- As part of its centennial celebration, the Michigan State College, School of Engineering is sponsoring a symposium on "Automation—Engineering for Tomorrow" to be held on May 12 to 14, 1955.

- Gar Wood's 65-ton Buckeye ditcher, reportedly the largest ever built is powered by a 300-hp GM diesel which supplies power to the excavator and tracks through the double Allison Torqmatic drive.

- An F-M, 10-cyl, opposed piston was recently placed in service at Burns Lake in British Columbia to meet growing demands of the area. This increases plant capacity to 2236 kw, according to the British Columbia Power Commission.

- Quebec Hydroelectric Commission recently took delivery of EMD rail-mounted power unit No. 100. The unit will be used for peak load skimming between 4 and 6:30 pm, and will be installed at the French town of Rimouski.

- According to the annual report of the American Standards Assn., there are now more than 1440 American Standards in use in the United States.

- Utilization of new sources of energy will be among the principal topics discussed at the 17th annual American Power Conference to be held March 30 through April 1, 1955 at the Sherman Hotel, Chicago.

- British Industries Fair is scheduled for London and Birmingham, England from May 2 to 13. Reportedly, this is the biggest national trade fair in the world.

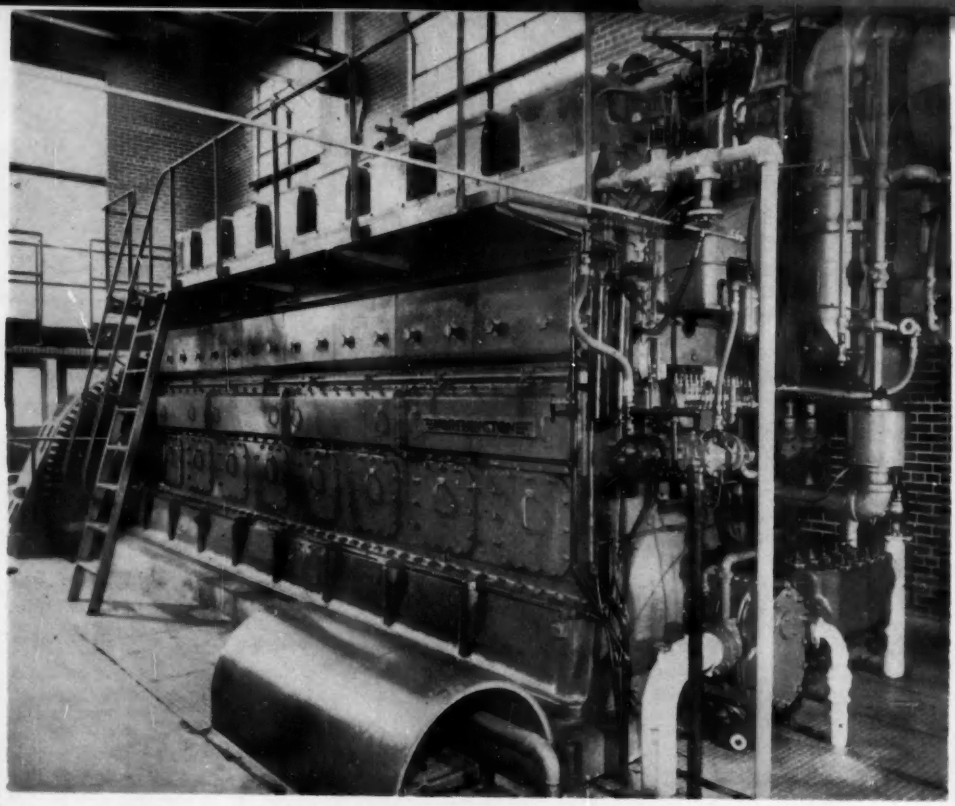
- Tenth annual meeting and lubrication exhibit of the American Society of Lubrication Engineers will be held from April 13 to 15, 1955, at the Hotel Sherman in Chicago, Ill.

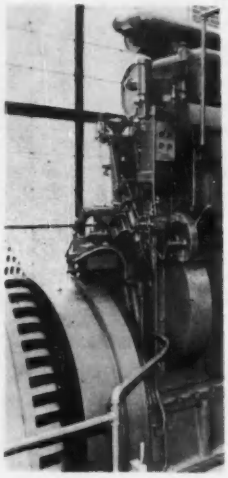
- The New Haven Railroad has ordered two lightweight trains from ACF Industries. This order makes the New Haven the second U.S. road to do so, the Rock Island being first by placing an order for a lightweight train with ACF last summer.

- With all the various turnpikes either authorized or proposed, it looks like a big year for the road builders in many states and also for the diesel-powered equipment needed to do the job.

- Commemorating the 50th anniversary of its founding, the Society of Automotive Engineers published this month a 56-page history of the organization entitled "The SAE Story".

- An automatic crankpin grinder that will pick up a crankshaft from a conveyor line, position the work in four successive grinding stations, and then place the finished work on a conveyor for movement to the next operation, has been developed by the Norton Co. It will grind one shaft a minute.





Lube oil pump end of one 8-cyl, 2010-hp Worthington dual-fuel diesel. A duplicate engine is on the left side, (not shown). Under hood in lower foreground is "before and after" pump. Engine controls at left.

Clyde Switches to Dual-Fuel

By Harvey A. Einhart, Manager of Utilities Village of Clyde, Ohio

Faced with a serious power shortage and continually rising generation costs, Clyde, Ohio decided on diesel power for its base load and standby service for its equipment.

MORE power was needed. This was the first problem facing Clyde, Ohio. Like other modern, thriving communities, their citizens demanded more power for the new electrical appliances which, together with a tremendous demand for an increase in industrial load, created a serious power shortage problem.

Power generation climbed steadily from 3,400,000 kw hr during the years 1945 and 1946 to 6,000,000 kw hr in 1953 (Curve 3, Chart 1). The rate of population growth in the last 10 years has been almost three times greater than it was during the preceding 30 years. The increase in population alone, however, does not give a true picture of plant load growth. A better indication would be the number of electric meters installed during a given period. The latter is shown in Curve 4 of Chart 1.

A Growth Problem

Clyde's municipal light plant began operation in 1893 with two 150-kw steam engines and a total investment of $2000. These were later followed in 1913 with two Schuse engines, one of 75 kw and the other 200 kw; and in 1924, a 350-kw engine was added. During the period from 1937 through 1940, the City Fathers discarded their steam engines and purchased two steam turbines, one rated 750 kw and the other 1250 kw.

This addition increased generating plant valuation to a little over $300,000, not including the distribution system. From 1940 until June of 1953, the turbines carried the entire plant load and coal continued to be the raw material depended upon to generate the steam required in the turbines.

Civic pride grew as Clyde suffered from growing pains and like many communities in that part of the country, lack of rain created an acute water shortage problem. Clyde's nine wells could not supply the ever-increasing industrial and domestic requirements. To supplement their wells, a 300 million gal surface water system with a design capacity of 2 million gpd was built in 1950. This again increased load demand which was already approaching the danger point too rapidly.

While the number of electric customers and the annual revenue from the sale of current increased yearly, as shown in Curve 2 of Chart 1, year-end profits steadily decreased due primarily to the rising cost of labor and coal. With no assurance that the price of coal would decrease, the City Fathers were now faced with the additional problem of operating economies.

More power was still needed. Should they continue with steam and purchase a new high-pressure boiler and turbine or revert to some other means of generating power? These were the problems—shortage of power and high generating costs.

Clyde's Board of Trustees of Public Affairs and Consulting Engineer Mr. Wilson W. Kohli of Tiffin, Ohio decided that the answer to their economic power problems was internal combustion, dual-fuel engines. In April 1952, competitive bids were received by the Board. The decision was to purchase two Worthington 2010-hp supercharged dual-fuel diesels. They were to carry the plant base load and the steam equipment would remain as standby.

Fuel Costs

Natural gas is not yet available to Clyde, so the engines are running on straight diesel fuel. Although the engines have been operating only a short length of time, they have demonstrated their ability to generate power at a considerable saving over steam. This is very clearly shown on Curve 2, Chart 2. Note the sharp drop during 1953 through 1954.

At the end of 1952, fuel costs averaged 11.3 mils per net kw hr when the entire load was carried by the steam equipment. By the end of 1953, fuel costs dropped to 7.88 mils per net kw hr as the diesels began to take over the load and the load during the period between 1953 and 1954 was divided between the turbines and diesels. Late in 1953 when the diesels took over the entire plant load, the curve leveled out again with fuel costs at the beginning of 1954 being what they were 10 years ago.

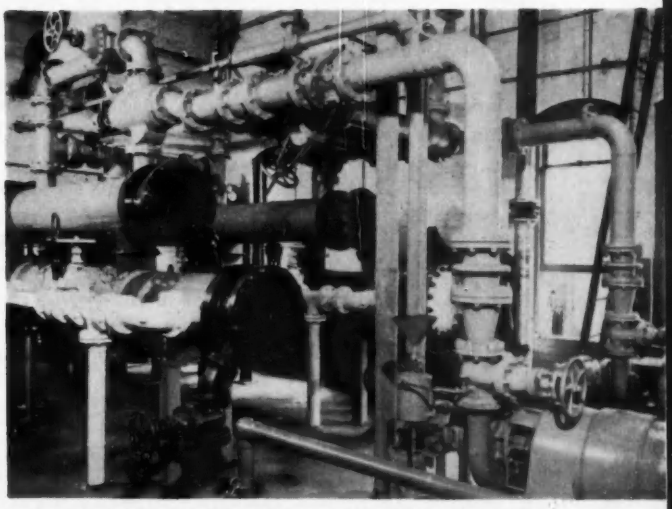
Permission to use natural gas is expected by 1955 and at a rate of 65 cents per thousand cu ft for natural gas and pilot oil at 9.59 cents per gal, a further saving in fuel costs will be realized. Fuel costs of 6.4 mils per kw is expected with gas and pilot oil operation.

This will be equal to steam generation costs of 15 years ago. For the past five years, the average amount of coal used per kw generated in the steam plant has been 2.49 lb. The diesel plant since it started operation has averaged 12.77 kw hr per gal of fuel oil with a running load factor of approximately 60%.

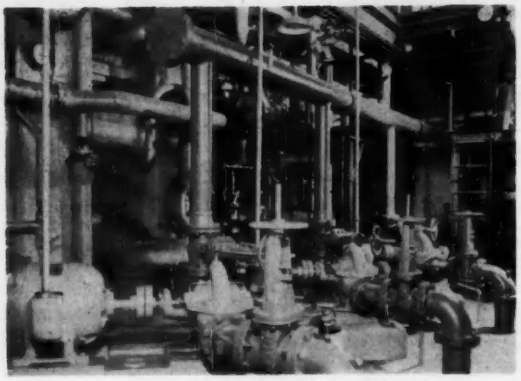
Comparative Figures

To show a direct comparison between steam and diesel engine operation, refer to the first eight month's totals of 1953 of steam generation and the first nine month's totals of diesel generation in 1954. September 1953 cannot be used in this comparison as this was the month when the diesel engines were being installed and both steam and diesel equipment were used to generate power.

Although steam unit No. 2 was used to generate some power in January and March of 1954, it amounted to such a small part of the total as to be insignificant. The total average monthly fuel bill during this period for the steam equipment amounted to $6,664.25 as compared to $4273.33 for the diesel, or 1.129 cents per kw for the turbines and .788 cents per kw for the diesels.



Two shell-and-tube type heat exchangers are for lube oil and two handle engine jacket water. Jacket water pumps are at right.



In one portion of the plant basement, three motor-driven, centrifugal water pumps have been installed for raw water circulation. Either engine can be served by any pump.

Steam plant accessory equipment consumed almost three times more power than that of the diesel plant, and at their generating rates, cost the Village of Clyde a monthly average of $1107.36 as compared to $271.55 for the diesel engines.

Water pumped for cooling purposes during steam operation was almost five times that used for the diesels. Gallons per kw generated monthly averaged 2.85 against .645 for the diesel operation.

A better example of comparison between Clyde's steam operation and diesel plant operation is shown for the months of March 1953 and April 1954 where the total kw generated is the same.

The steam unit fuel cost for this one month's generation amounted to $6244 and for a like power interval, $4608 was spent for diesel oil. Had 1000 Btu per cu ft natural gas, at a cost of 65 cents per 1000 cu ft been available, the fuel cost would have been $3757. The steam plant auxiliary equipment consumed 91,540 kw, and 1,668,000 gal of water were used for cooling, while the diesels used 36,100 kw and 308,000 gal of water.

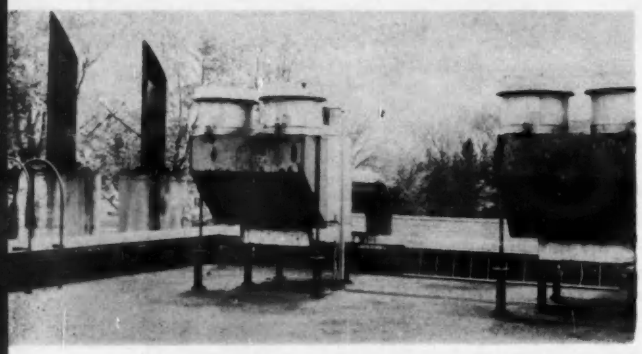
Plant Arrangement

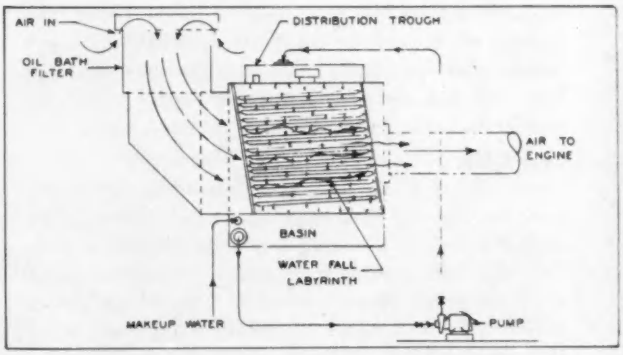
Plant operation and design contribute greatly to Clyde's outstanding operating economy. All station auxiliary equipment is easily accessible for repair and maintenance. Air starting compressors and tanks, lube oil purifiers, jacket water pumps, shell-and-tube-type heat exchangers for jacket water and lubricating oil cooling are located in a separate room in the rear of the engine station. Three horizontal split case centrifugal raw water pumps are located in the basement and piping interconnected so that either engine can be served by any pump.

Installed on the power plant roof are two *Aquatowers* used for precooling the intake air (See Fig. A and photograph). It is possible to totally saturate this intake air and thereby reduce the ambient air temperature down to almost wet bulb temperatures. Circulating water is pumped to the precooler distribution trough where it trickles downward through a series of baffles in the intake air stream, settling in the basin to be recirculated. Make-up water is maintained by a float valve in the precooler basin. Fresh intake air passes through oil bath filters before entering the precooler.

During periods of straight oil operation, the precooler is not used as humidified air is not beneficial for diesel operation.

The engine gaugeboard is located between the two engines, easily visible to operating personnel. Station piping is painted with different colors, designating air, water, lubricating oil, gas, and fuel oil. Jacket water is conditioned by the Cromate process and circulated continuously through both engines. Either engine is then available for immediate loading without the normal prewarm-up period. Jacket water is also used for plant heating during the cold season.





Intake is drawn through oil-bath type air filters and precoolers, located on the plant roof. Precoolers reduce ambient temperature to almost that of wet bulb. Fig. A at right, shows air flow through precooler.

STEAM OPERATION

Year—1953	January	February	March	April	May	June	July	August	September
KW Generated—Steam Unit #1	000	000	2600	000	2000	000	9800	000	000
KW Generated—Steam Unit #2	624,800	720,500	585,400	607,600	561,500	567,800	524,700	504,900	525,500
Total Generation (kw)	624,800	720,500	588,000	607,600	563,500	567,800	534,500	504,900	525,500
Station Use (kw)	94,180	110,920	91,540	98,540	96,080	99,320	101,220	92,240	101,660
Free Power to City (kw)	17,575	18,240	14,376	13,682	12,360	11,092	9942	11,864	13,313
Plant Water Consumption (gal)	2,341,000	1,653,000	1,668,000	1,775,000	1,589,000	1,602,000	1,487,000	1,361,000	1,469,000
Lb of Coal per kw hr	2.40	2.50	2.36	2.35	2.44	2.58	2.62	2.64	*
Coal Cost per Ton	$8.90	$8.95	$9.00	$9.00	$9.30	$9.30	$9.30	$9.30	$9.30
Fuel Cost	$6672	$8060	$6244	$6425	$6390	$6816	$6510	$6197	

*Combined Operation

DIESEL ENGINE OPERATION

Year—1954	January	February	March	April	May	June	July	August	September
Kw Generated (Steam Unit #1)	000	000	000	000	000	000	000	000	000
Kw Generated (Steam Unit #2)	13,300	000	2600	000	000	000	000	000	000
Kw Generated (Diesel Unit #1)	460,700	321,500	157,400	275,600	233,600	169,400	267,100	260,000	275,900
Kw Generated (Diesel Unit #2)	170,400	314,600	380,200	312,400	244,300	324,800	205,600	232,900	253,200
Total Generation (kw)	644,400	636,100	540,200	588,000	477,900	494,200	472,700	492,900	529,100
Station Use (kw)	38,700	38,240	34,540	36,100	31,820	33,720	33,540	31,500	32,040
Free Power to City (kw)	18,475	16,739	13,526	13,798	11,122	10,690	10,531	9127	10,209
Plant Water Consumption (gal)	231,000	548,000*	461,000*	308,000	340,000	215,000	343,000	418,000	285,000
Kwh per Gal.	13.00	13.00	13.37	13.00	12.52	12.65	12.18	12.116	13.077
Cost of Oil per gal.	.1019	.1019	.1019	.1019	.1019	.1019	.1019	.0959	.0959
Fuel Cost (Steam)	$143	000	$28	000	000	000	000	000	000
Fuel Cost (Diesel)	$4946	$4985	$4097	$4608	$3888	$4022	$3961	$3901	$3881
Total Fuel Cost	$5089	$4985	$4125	$4608	$3888	$4022	$3961	$3901	$3881

*These were high due to leakage in float valves and drainage for changes in piping.

SOME TOTALS

	Steam	Diesel	Steam 8 Mo.	Diesel 9 Mo.
Kw Generated	590,075	541,722	4,720,600	4,075,500
Kw Used for Station Use	98,000	34,466	784,040	310,200
Gallons of Water Used by Plant	1,684,500	349,888	13,478,000	3,149,000
Fuel Costs	$6664.25	$4273.33	$53,314	$38,460
Fuel Cost per Kw Generated	$.01129	$.00788	$.0113	$.00788
Cost to Operate Accessories	$1107.36	$271.55	$8859	$2444
Plant Water Used per Kw Generated	2.85 gal	.645 gal	2.85 gal	.645 gal

Operation

The load is divided between the two engines to equalize wear on rotating parts. A periodic system of engine logging at half-hour intervals is strictly adhered to.

The importance of preventive maintenance is continually stressed at meetings of operating personnel and has been proved by the small amount of trouble encountered by this plant.

Clyde's engines are designed to produce maximum power output at high ambient air temperatures. Dual-fuel engines perform better with saturated air than they do with dry air. Saturated air lowers the initial temperature of the charge in the cylinder and therefore the end compression temperature. The molecular structure of gas tends to break down under high pressure and temperature into knock-producing compounds. Detonation is prevented by lowering compression temperature which suppress these knock-producing compounds. Saturated air obtains additional cooling by virtue of vaporization.

Incentive Too!

Several years ago, Clyde started an incentive system to make their operating personnel more versatile in their operating duties. Their men are trained to do limited

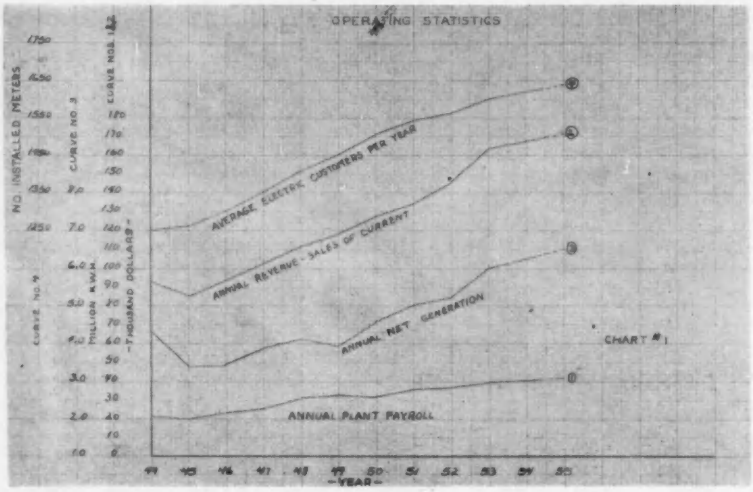


Chart I clearly illustrates the growth pattern.

maintenance on the diesels, turbines, and to make complete analysis and titration tests on the water in the filtration plant. All expenses are paid by the City for those who want to attend specialized classes at the University in Columbus, Ohio. After the men have passed the course and obtain a license, they are given additional remuneration in their weekly pay envelope.

No new operators were hired when they changed from steam to diesel generation. Key men who had obtained their diesel engine schooling were sent to the factory where the engines were built for further instruction in diesel maintenance operation. The general slope of Curve 1 of Chart I is much sharper up to 1949 when this incentive system came into existence. Plant payroll is expected to increase, but at the same gradual curve rise since 1949. As the scope of the operator's duties increases, part of his salary will be chargeable against other departments in the municipal system.

Last year Clyde had a net revenue of $305,895 from its electric power and water plants. This was, in part, accomplished by employing the use of a more efficient means of producing power.

More water was available for revenue, and more power was available to the consumer. With the expectation of gas in the near future, dual-fuel operation can be expected to result in further savings.

Principal Equipment

Engines	Worthington Corp.
Generators and exciters	Ideal Electric Mfg. Co.
Air starting equipment	Worthington Corp.
Heat exchangers, lube and water	Sims Co.
Lube oil purifiers	Honan-Crane Corp.
Pumps	Worthington Corp.
Fuel oil strainers, edge-type	Cuno Engineering Corp.
Exhaust silencer	Maxim Silencer Co.
Intake air filters and silencers	Air-Maze Corp.
Intake precoolers	The Marley Co., Inc.
Pyrometers	Illinois Testing Laboratories, Inc.
Alarms and shutdown devices	Worthington Corp.

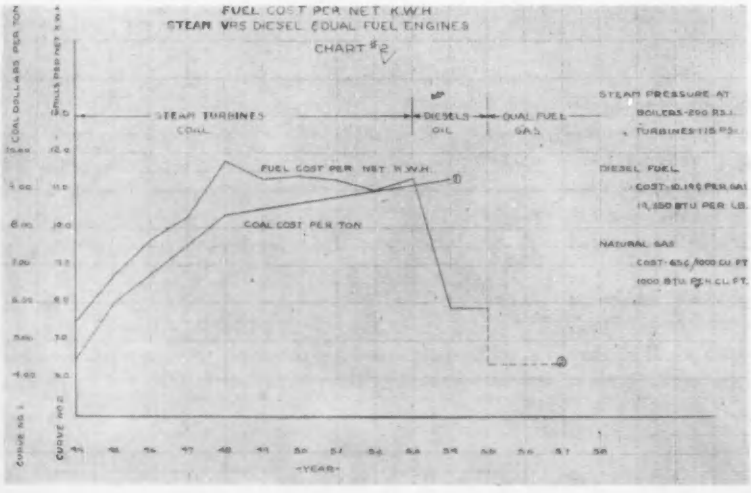
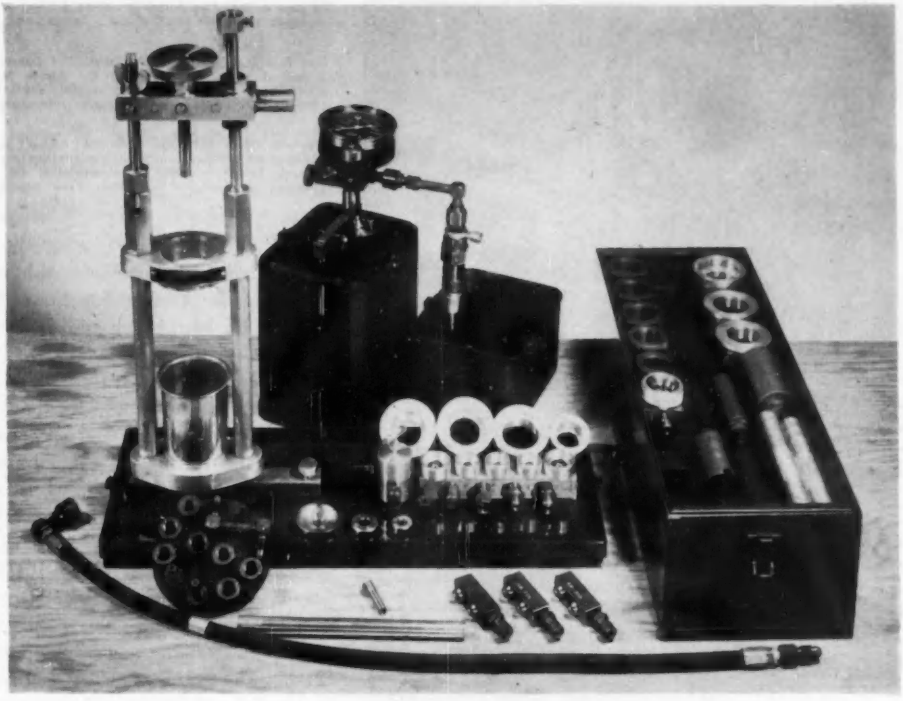


Chart II shows the effect of diesel fuel, and eventually gas, on cost of generation.



Complete universal test stand and test pump for testing all GM and Cummins injectors. Fittings may be broken down into three sets when full scope of testing is not required.

Testing Unit Injectors

A new test kit extends the scope of testing for all unit injectors both in the field and on the bench.

UNIT injectors are pretty hard things to test. By combining the high-pressure pump and the nozzle in a single unit, the process of testing the individual functions becomes more complex than it is with individual units. A further complication, held in common with the individual-type high-pressure pumps, is that there is no actuating mechanism when they are removed from the engine for test.

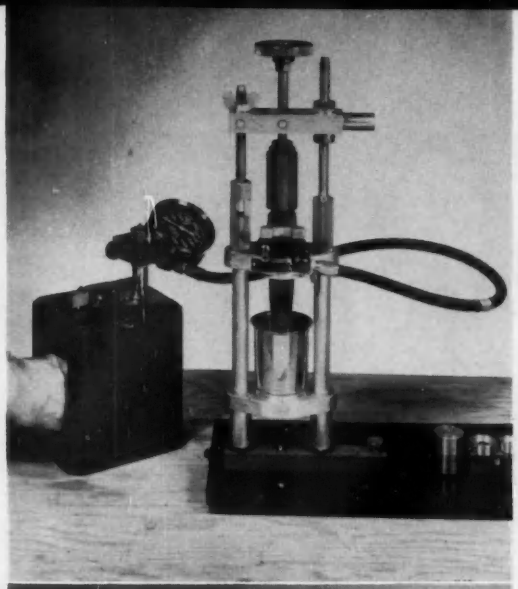
The nozzle portion of the unit injectors responds to conventional nozzle testers when the proper fixtures and adapters are used. Tests can be made for popping pressure, leakage, check valve seating, and correctness of the spray pattern. Levers may be used to actuate the pump plunger to supply high pressure fuel or a separate pump can be used. However, if you are going to test all types and models, several stands, accessories, and adapters are generally needed.

Checking the pump portion of unit injectors in the manner of the en-bloc or distributor-type pumps is a tougher problem. It would take a very complex machine to mount the injectors, supply the proper cam drives, and supply all the various other accessory equipment so that the wide variety of designs could be calibrated on the basis of comparative fuel delivery. This obvious complication has led to a different approach.

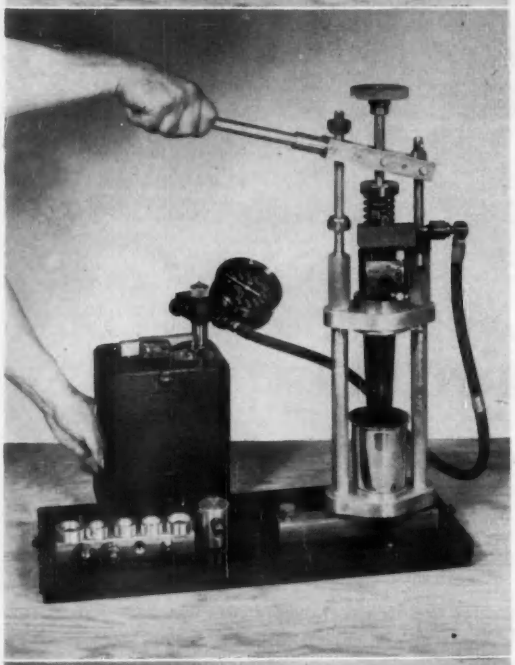
Leak-off rates at high pressure are commonly used to determine plunger and barrel wear. Beyond this, reliance is generally placed on visual inspection. Referring to individual-type pumps again, when good test stands became more available, it was found that visual inspection was subject to considerable error. Parts discarded by eye often showed up okay on tests—and vice versa.

Summing all this up, it shows that testing all types of unit injectors is a complex problem. Because of this, it is common practice to make only certain tests and rely on the "take-a-chance" or "replacement" route to take care of the rest. There hasn't been much choice.

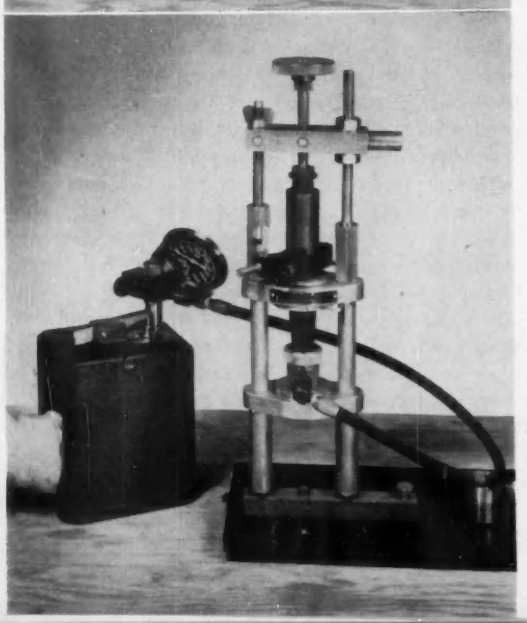
Kiene Diesel Accessories, Inc. has made a good stab at remedying this situation with a light, compact, and relatively inexpensive test kit that, in addition to all the



Plunger condition, check valve seating, screw cap leakage and spray pattern of this Cummins injector can be tested in this setup. The beam is set as a strongback to retain the plunger by the hold-down sleeve and gag nut (top).



GM injector being popped with the beam used as a lever. Rounded nuts are loosened for beam freedom. Note the block across fuel inlet and outlet. Outlet is blanked and seal by "O" rings. Pump supplies low-pressure fuel (center).



Reverse flow through orifices of a Cummins injector. Plunger condition, check valve sealing and tip sealing are tested. Beam is set as strongback to restrain plunger. This is typical of reverse flow connection (bottom).

tests currently being made with nozzle testers, can perform further testing functions. Its concept makes it suitable for both bench and field testing.

Kit Details

The stand itself is the backbone of the whole kit. All of the adapters, caps, and spacers are for setting it up so that the various tests can be made on the different unit injectors. The full kit is set up to handle the GM 51, 71, 110, 268, 278, and 567 injectors, plus the Cummins injectors. With the stand as basic equipment, accessory kits can be obtained for Cummins injectors, standard tests on GM injectors, or a more elaborate kit to permit barrel and plunger tests as well.

The illustrations make it apparent how by changing the height of the lower platform plate and the use of fittings, the stand is adapted to accommodate different size injectors. The design of the upper portion is unique since it allows for the use of the beam either as a strongback or as a popping test lever.

Kiene's portable hydraulic test pump is a companion piece to the stand. It has its own fuel supply and the ability to produce pressures throughout the desired range. Thus it can act as a supply pump when the beam is used to actuate the unit injector's plunger, or supply high pressure fuel for other tests when the beam is used as a strongback.

The whole rig is portable. The stand comes apart to lie in a flat box that houses some of the accessory fittings. Maximum use of aluminum cuts down the weight. The pump, with its cover in place, forms a single dirtproof unit with a convenient carrying bar. The whole thing can be easily carried and set up anywhere for testing the injectors.

Tests

Conventional tests need little explanation. By use of adapters and the test pump it is possible to supply fuel under pressure in the normal direction of flow or backwards, either through the orifices; or in the case of the GM plunger and bushing tests, directly into the pumping chamber. With normal flow, popping pressures, seat leakage, and spray patterns can be checked. If the orifices are blocked, leakage past plungers and general leakage due to faulty seals or loose assembly can be found.

Reversed flow will test check valve seating and will also show up faulty plunger to barrel sealing.

Barrel and plunger assemblies of all GM injectors can

be tested with the nozzle assembly and nut removed. The proper cap bushing is placed in a holder having a fuel supply connection and secured to the lower platform. The upper platform is fitted with a bushing to accommodate the injector. A holding nut slips over the injector barrel as it is inserted through the upper platform and centered in the lower cap. This holding nut engages the threads on the unit injector body and bears against the bushing of the upper platform. As it is tightened, it draws down the injector barrel against the "O" ring in the cap and thus seals the lower end of the barrel.

A spring cap is placed over the spring and follower guide of the injector, after which the beam is adjusted as a strongback, with the graduated center screw bearing in the center hole of the cap. A reference nut is placed on one stud of the stand as shown. The operating wheel on the center screw is graduated to show every thousandth of an inch of vertical movement. Each full turn or 0.050-in is marked on the reference nut to keep track of cumulative movement.

With this setup, a good check on plunger and barrel leakage is possible. The plunger is moved to close the ports, pressure built up, and the rate of leak-off noted. Seepage will show up at the top of the bushing or at the ports. If tests are made on injectors of the same type, it gives a good comparison of their general condition. A good idea of the condition at the lips of the helices can be had by noting the leak-off rates when different portions are just closing the ports.

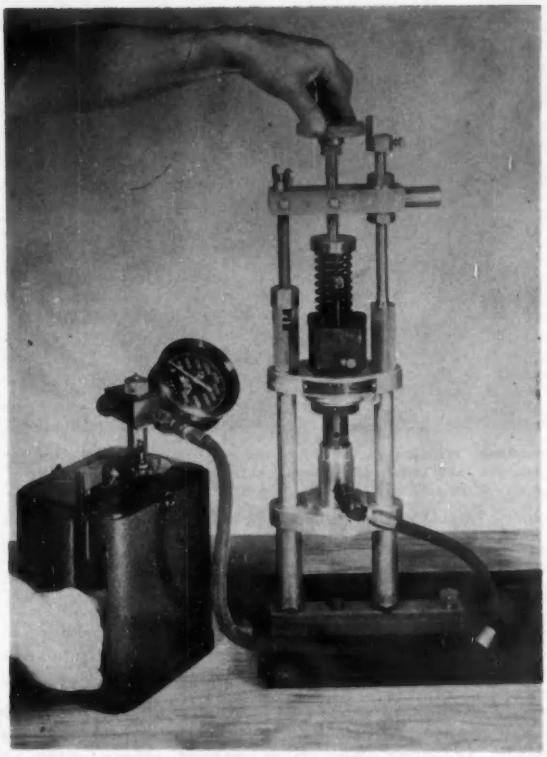
Effective stroke at full rack or selected intermediate settings can be measured. With the rack set, nominal pressure is built up and the center screw turned until the pressure builds up indicating port closure. Maintaining pressure, the screw is backed off until a fine mist appears at the port. Screw position is noted and then turn-down continues until the fine mist just starts at the spill port.

Screw travel is computed and is equal to the effective stroke at that rack setting. Comparative tests are made on injectors of the same type. If the strokes are the same at the same rack settings, and the leak-off rates are reasonably equal, chances are that all the injectors will deliver the same amount of fuel. This is a form of calibration.

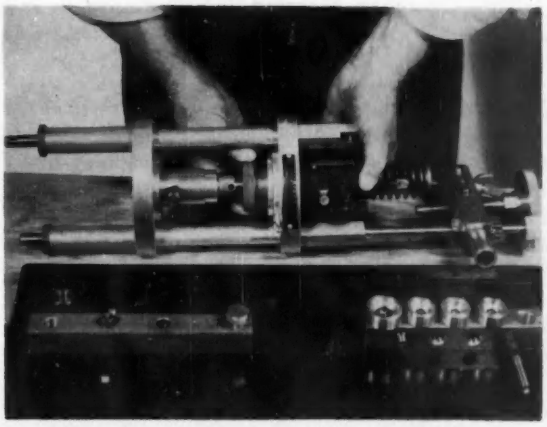
Summary

Both the test stand and test pump were developed with field requirements in mind. Their design for portability shows this. They offer a chance to extend the scope of testing both in the field and in the shop with low-priced equipment.

Test results in most cases are relative rather than absolute, as they would be at the factory or with elaborate equipment. But relative results are generally sufficient to pinpoint troubles right at the job site and so keep critical equipment running. The flexibility of application, low size and weight, plus low cost, should make this equipment a very valuable service adjunct.

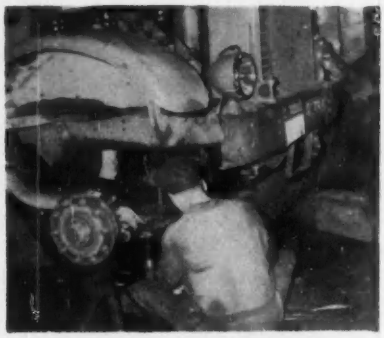


Reverse flow applied for a plunger and barrel test of a GM injector. Effective stroke is checked by use of a graduated hand wheel and reference nut on stand stud. Condition of plunger, barrel and helix lip are also checked.

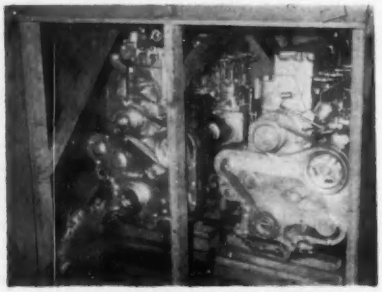


Mounting the GM injector for barrel and plunger test. Note how hooked stand stud easily swings free. Holding nut is being tightened on injector body threads to pull barrel face against "O" ring in cup for sealing lower end.

Mechanics at Inland Motor Freight not only repair the equipment, but also road test it and where necessary, "run-in" the engines.



IMF does most of its own maintenance and rebuilding work from the wheels up. Injection equipment however, is "farmed out" to a local shop specializing in this type of work.



Like "chicken under glass", rebuilt diesels are stored in a dust-proof box until needed for a change-out. This reduces down time.

Planned Truck Maintenance

Good maintenance starts with a plan. There is no one best plan; it must be tailored to fit the operation. Here is how one firm makes their plan work.

by Robert H. Forbes

THE ratio of diesel fuel to others used in trucks of the Inland Motor Freight, Spokane, Washington, reflects their trend toward diesel power in their highway trucking business. This ratio is 62 to 8, or nearly 8 to 1. IMF, as the company is known locally, operates 5 million highway miles per year in eastern Washington, northern Idaho, and northeastern Oregon.

All of IMF's diesels are built by Cummins, but they have been placed in Kenworth, Peterbilt, Sterling, and GMC trucks. The latest is a Kenworth "glider truck". These rigs are picked up, minus the engine, two transmission and final drive unit, at the Kenworth factory in Seattle. They are brought to Spokane by a regular IMF truck, along with the missing units. Shop men do the installation and then break in the new trucks.

The planning for maintenance follows the accepted pattern. It starts with records. Then there are routine jobs and inspections at scheduled intervals. As mileage piles up, these become increasingly more searching and the work heavier in nature. All this is backed up by a good parts department, departmentalized shops, and good supervision.

To set up a plan is one thing, the results you get are something else. The degree of follow-up, the quality of the work, and the ingenuity shown will all determine if the maintenance plan is serving its sole function—to "keep 'em running" at minimum overall cost.

One decision that must be made in any maintenance operation concerns what work should be done in the shop and what should be farmed out. It might be a matter of tools required, or special skills, or the relationship of these to the volume of a particular type of work. IMF, for example, farms out all injection pump work to specialists at Spokane Diesel Electric Company or the Cummins factory branch.

Henry Williams, shop superintendent at the IMF Spokane terminal, feels that this practice is the most economic and produces the best results. He reports better fuel mileage and longer pump life than if pumps are repaired in the shop. He thinks that this is due to the specialized skill and better testing equipment at the injection repair shops. Also, they have stocks of new parts for immediate replacement whenever there is a need for them.

Records

IMF's operation involves the Spokane shop and outlying stations. Once a year, unless a truck is less than 6-mo old, the stations send them to Spokane for checks on oil consumption, cylinder compression, condition of wheel bearings, brakes, and 60 other items. When necessary, engines are pulled and spares installed.

Inspection and servicing at the stations must be controlled. One device consists of monthly reminders to check radiators, clean batteries and posts, send in oil samples, report on tires, or any other of the many jobs to be done.

Good workable records, adequate but not elaborate, are a "must" with IMF's type of operation. A handy Zephyr Rolodex card file of trucks and trailers by numbers has been inaugurated in the IMF shop office. Repairs are indicated by a system of code numbers.

First signs of trouble are picked up at routine maintenance checks and from entries in the drivers' "cry" books. Drivers fill these in after every run. They are made in triplicate with one copy going to the shop, one to the dispatcher, and the third left in the book. The foreman checks off all "cries" taken care of or notes in the book why they were not. Road-failure mechanics fill out a form in duplicate. One copy goes to the timekeeper for check with the driver's report. The copy left in the book is for shop use in analyzing failures and determining any laxness in the system.

Shop Setup

Many IFM methods are adaptations of successful ones passed on from other operations. Others are original, being developed in the shop under the direction of Henry Williams. Organization of the shop and the policies followed stimulate interest among the shop men.

The shop is departmentalized. There is a section for diesel engines; one for gasoline engines; one for gear boxes; another for cylinder heads, air compressors, and reefer engines; and one specializing in air and electrical jobs. Five specialists out of the 18 shop men normally handle their particular type of overhaul and service work. Slumps and overflows in a department may occur, but as a rule everything runs steadily.

Where possible, mechanics keep their own records on a mileage basis in addition to those kept in the shop office. In this way they can keep track of their jobs. Specialization on one activity pays off in time saved and almost complete elimination of "come-backs". Mechanics are more inclined to take pride in their work and study the parts they handle, often developing worthwhile changes.

In the engine departments a "rebuild" mechanic, upon completion of an overhaul, starts the engine on its way. He installs it, tunes it up, and road-tests it. This gives him the feeling that he has a stake in it.

Shop work is backed up by a stock room. Spare units and parts for engines, transmissions, chassis gear, etc., are kept on hand to insure a minimum of shop time if trucks need rebuild jobs. Experience has shown the particular items and quantities to have on hand.

Some Results

The quality of a maintenance program is reflected in a number of ways. A good index is found in lubrication practice because so many irregularities show up on the condition of the lubricant. Through progress in servicing, oil mileage has been greatly increased. Diesel oil changes have gone up from 1500 to 5000 miles. Oil condition is consistently monitored by sending samples to the Faber Laboratories in Seattle.

Any irregularities in the injection equipment, cylinder parts, oil or air filtration, show up even in their early stages as dilution and/or contamination of the lube oil. On this basis, troubles can be corrected before more serious—and costly—situations develop. With the improvement in mileage, all attempts to reclaim oil have been stopped. There is a settling tank and the best drainings are saved for air cleaners.

Other inspections also show the effect of good practices and catch troubles at the start. Front wheel bearings are now checked at 15,000 to 20,000 miles; all others at 40,000 to 50,000 miles. Wheel-bearing records are kept railroad-style by using marking pencil right on the truck cab or trailer body. Chassis lubrication periods are being extended from 1000 to 2500 miles on the basis of better lubrication and new products.

Periodic inspections must, of course, include the whole truck. These are spaced in accordance with its make and age. On long runs, a check is made after every trip. This includes not only the engine and accessories, but steering arms, brakes, drive line, lights and tires.

The extreme value of such inspection is demonstrated by the fact that one manufacturer replaced 12 front hubs with an improved design after IMF men found and pulled off four cracked ones. One hub of the early design broke on a curve and sent the truck through the guard rail.

Ideas Cut Costs

For maximum effect, the maintenance program must extend to the entire piece of equipment. For example, installation of back bumpers of solid molded rubber materially cuts breakage of trailer doors and corners. Edging the loading docks with old tire sections also helped. Then, the selection of a single-piece door with a minimum of wearing parts and one lock cut maintenance.

Tire chain wear was reduced about 60% by applying a hard facing with cast iron welding rod. A new toggle-type fastener was developed by IMF men. Used on trailer safety chains, it has no hooks but will not become unfastened.

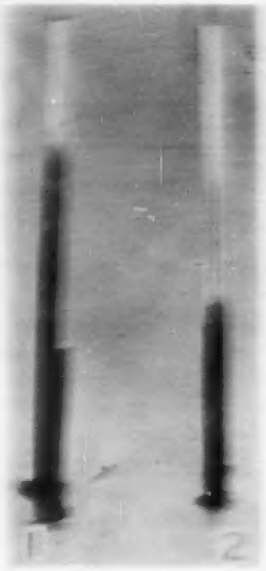
A rubber-bushed rear axle spring kit that originated at IMF not only helped them but others. Its weight-saving and parts-reduction features, plus its ease of maintenance, made it so satisfactory that it is now manufactured by Page & Page, Portland, Oregon. The kit is used with 3-axle trucks and 3-axle trailers. All of this is evidence that IMF not only has a sound maintenance program but that it has the degree of follow-up, quality of work, and ingenuity necessary to make it work well.

When To Drain and Why

By Lewis F. Moody, Jr. and John C. Gibbs*

Staff Engineers, Lubricating Department
Socony-Vacuum Oil Co., Inc., New York

You can control some of the factors that determine the interval between oil changes. Longer oil service yet with adequate diesel engine protection can be obtained if you know the answers and do something about it.



Worn piston rings from diesel in city bus service. Occurred at 1000 mi. Caused by abrasive dirt. Note depth of ring wear extending below inset grooves.

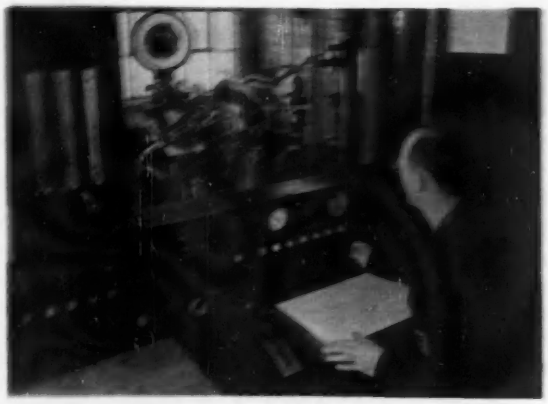
Oil, kept too long in service results in dirty engines, often accompanied by excessive wear or damage to parts due to impaired lubrication. Unnecessarily frequent oil changes, on the other hand, are wasteful and costly. This makes the subject of oil-change practice one of constant interest to operators of all diesel engines, leading them to ask, "What determines the proper time to drain oil?" To answer this, we must first understand what we expect oil to do and how we measure its performance.

Diesel engine lubricating oil has many tasks to perform. It must lubricate moving parts over the wide range from full-fluid film to boundary film conditions. It must seal piston rings to prevent excessive blowby, offset corrosive effects of combustion products on cylinder walls, and prevent corrosion of hard-alloy bearings. It must protect against rust under conditions of low crankcase temperature and during downtime.

Further, the oil functions as a heat-transfer medium and must be stable against the effects of heat and oxygen. It must have ability to keep engine parts clean and free from power-robbing deposits, and finally, be able to do all these even when burdened with an appreciable load of contaminants.

Some things oil cannot do. Even the best oil cannot replace worn-off metal or prevent metal fatigue failures. It cannot repair or overhaul an engine or overcome effects of overload or an operator's ignorance or carelessness. It cannot suspend unlimited amounts of solid contaminants and still lubricate; nor can it offset the viscosity-lowering effect of fuel dilution.

Some form of oil purification, supplemented by periodic oil drains, is needed to rid the engine of liquid and solid contaminants. Among these are water, soot, road dirt and air-borne dust, engine wear metals, oxy-products from fuel and from the oil itself, and corrosive sulfur from the fuel.



Typical laboratory diesel installations for lubricant, fuel, and engine performance studies.

*Abstract of a paper "Factors Affecting Oil Drain Practices for Diesel Engines" presented by the authors before a session co-sponsored by the Lubrication Activity and the Oil and Gas Power Division at a recent ASME International Meeting in Mexico City.

Full-scale 2-cyl railroad diesel installed in laboratory for research,

Factors which affect the oil-change period are the same as those which affect engine performance. These are engine design and manufacture, operating conditions, quality of maintenance, fuel, and finally the lubricant.

What the diesel engine operator wants is reliability and economy of operation. The proper type of oil and the proper oil-drain schedule are as much a part of good preventive maintenance practices as mechanical adjustments to engine valves or fuel injectors.

Engine Design and Manufacture

This is considered as a major factor in oil performance although certain design items are at first sight apparently of minor importance. From the long list possible, two examples will suffice to illustrate the point.

A number of years ago an engine manufacturer changed from babbitt to copper-lead bearings without increasing clearances. The result was an epidemic of bearing seizures and seeming bearing corrosion. Oils were blamed as a matter of course; oil change periods were shortened. However, the trouble disappeared as soon as bearing clearances were increased to the proper limits for the harder bearing alloy. This also resulted in lower oil temperatures, a desirable condition obviously.

As a second example involving design, the recommendations of a prominent builder might be cited. With the large-capacity lubricating system, the builder recommends oil change periods of as high as 1500 hr. The same engine fitted with a shallower oil pan (and hence of lower oil capacity) carries the builder's oil change recommendation of 500 hr. With a third and still shallower oil pan, the drain recommendation is only 250 hr.

Operating Conditions

Operating conditions which are most important are air temperature, nature of service, engine load and speed, atmospheric dust conditions, and, where pertinent, driver habits. Operation in cold weather at low speed and with much idling promotes corrosive wear and low-temperature sludge deposits.

High-speed, over-the-road service involving overloading and lugging may promote incomplete combustion, which leads to engine deposits and clogged and stuck piston rings and to exhaust smoke. Operation in dusty air with an improperly functioning air cleaner or a leaking air system promotes abnormal engine wear and contributes to deposits. Overspeeding as well as overloading or lugging shortens bearing life.

Maintenance Practices

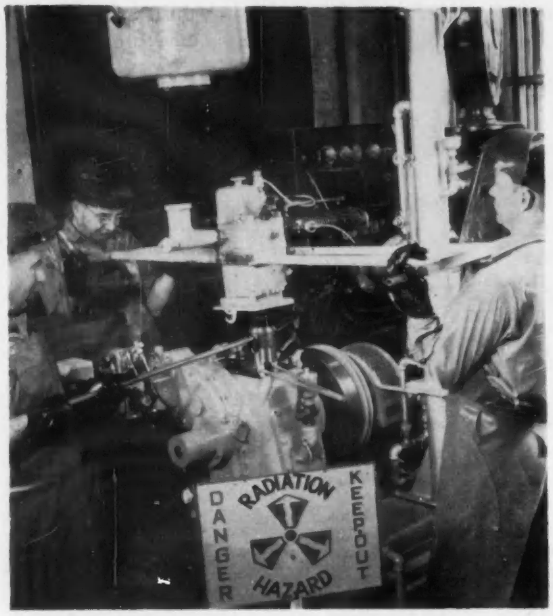
Numerous maintenance factors have a direct bearing on engine wear and the rate of deposit accumulation. These include condition of the cooling system, air cleaner and crankcase ventilator, injectors, as well as oil-filter renewals, and crankcase drain period. What is done when engines are overhauled often leads to complaints against the lubricant used. Failure to clean out all residues from crankcase and crankshaft oil passages can lead to decreased oil circulation and early bearing failure from insufficient lubrication.

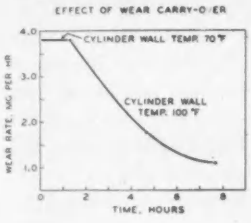
Deposits—If not thoroughly removed from crankcase interior surfaces, particularly in corners and pockets and around main bearing webs, deposits can dry out while an engine is down for overhaul. Then, when the engine is returned to service, some of this deposit may shake loose and fall into the oil sump. It is carried by the oil stream through lubricating lines to the bearings where it becomes imbedded or where it scores the bearings. Even oil line clogging is possible from this cause. Finally, any residues can only serve to contaminate the fresh oil as soon as it is put into the crankcase.

Abrasive Dirt—This is probably an engine's No. 1 enemy. The importance of adequate air cleaning and maintenance of the induction system to prevent dirt entry cannot be overemphasized. Even though air cleaners may receive periodic attention, air-borne dirt can enter if there are any loose joints or cracks on the clean air side of the induction system.

If a sample of used oil shows more than 0.1% silicon in the ash, it is probable that a dangerous amount of abrasive dirt is entering with combustion air. Confirming evidence of rapid engine wear is found by a significant increase in the amounts of iron, aluminum, and bearing metals present in the crankcase oil.

Fuel-System Condition and Operation—These have a major bearing on engine behavior and oil condition. Worn, improperly operating injectors permit fuel to dribble into combustion chambers at the wrong time



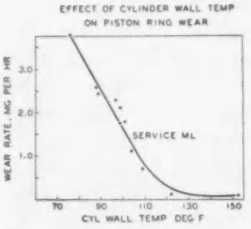


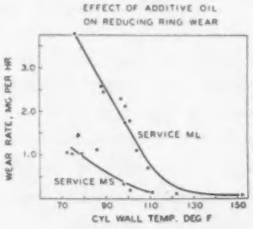
Above, CFR radioactive wear engine setup. Test results below.

Reduction in ring wear rate with time after increase in cylinder wall temperature (left).

Effect of cylinder wall temperature on piston ring wear rate (lower left).

Effect of lubricant quality on piston ring wear rate (below).





in the cycle, leading to piston-top erosion and burning. Unbalanced fuel delivery rate among the cylinders in an engine causes incomplete combustion in some cylinders, leading to smoky exhaust and ring sticking or clogging.

Crankcase Ventilation—It is necessary to rid engine crankcases of blowby fumes and water vapor. With impaired ventilation under low temperature (below 140°F) crankcase conditions, water vapor can condense with the resulting liquid water promoting the formation of emulsion (mayonnaise-like) sludge.

Many engines of road vehicles employ a draft-tube type crankcase ventilator which depends on vehicle speed for the necessary ejection effect. Where vehicles are engaged in low-speed or intermittent start-stop service, the draft tube may produce insufficient ventilation.

To obtain positive ventilation, the engine may be fitted with a device that employs air inlet manifold vacuum to remove fumes from the crankcase. This system includes a restriction in the suction line to limit the eduction rate and thereby prevent oil pullover. A sluggish or inoperative valve in the vent line will lead to oil deterioration and engine malfunctioning because of impaired ventilation, or too rapid oil pullover. The latter results in high oil consumption as well as sticking of piston rings and sticking or burning of engine valves.

Leaks—Not all water reaching the crankcase, originates from the blowby of combustion gases as there may be an actual leak in the cooling system. Sometimes this is hard to detect especially if it occurs slowly. Usually such a leak is indicated where chromate water conditioners are used by chromium appearing in the ashed oil sample. Relatively large accumulations of water usually are strong proof also of a cooling system leak.

Influences of Fuel

The automotive diesel operator has some freedom of selection of fuels with his basic choice being between the high-quality, high-speed diesel fuels or the burner oils in the form of No. 2 or occasionally an even heavier distillate fuel oil. Of particular importance are the matters of cetane number, end point, and sulfur content. The heating oils as a class will give less clean combustion however, and this disadvantage is reflected in higher maintenance costs, the need for a more expensive lubricating oil, and more frequent oil drains. Ability of engines to adjust to harder-to-burn products varies considerably.

Incomplete Combustion—At high load and especially at low temperatures, too-low fuel volatility is the principal cause of soot and smoky exhaust. The soot remaining contributes to combustion chamber deposits chiefly, but that part blown into the crankcase serves to contaminate the oil. Incomplete combustion can also cause lacquer formation, the effect depending on the fuel and operating conditions.

Sulfur Content—Widely discussed in recent years, this has an important influence on oil deterioration and on engine deposit formation and wear, particularly of cylinders and rings. It is important to know that running an engine cold with low-sulfur fuel will cause far more rapid bore and ring wear than will a high-sulfur fuel in an engine run with jackets at proper temperature.

Products of fuel combustion are acid in reaction, markedly so when sulfur is present. Water as steam is a major component of combustion gases. If cylinder walls are cold enough to cause condensation of steam, the resultant water can become strongly acidic and attack cylinder walls, rings, and in some instances, aluminum pistons. It can also react with the oil film on the cylinder to form undesirable deterioration products.

Once an engine is in his hands, the operator has con-

trol over the factors of operation, maintenance, and fuel, (discussed above), and the final factor, lubricant. Assuming that he runs the engine with the same oil, he is still faced with the variables of the three other controllable factors. This usually makes it difficult for him to observe a general policy with regard to crankcase drain intervals.

Oil deterioration or contamination is a function not only of the quality of the oil but of the burdens imposed on it by the other factors. Insofar as the operator controls these factors for good or bad, he controls both engine condition and the determination of oil change periods.

Examples of Oil Condition

A few examples of how analysis of crankcase oil can help identify an unfavorable operating, maintenance, or fuel factor, may be of interest at this point. For the first case, Table I, a city bus operation will be compared with operation of the same engine in high-speed, cross-country service in its effect on the oil. The characteristics of the new oil are included to enable the diagnostician to establish the changes that have occurred in service.

Respecting used oil sample No. 1, the increase in API gravity suggests fuel dilution which is confirmed by the lower viscosity. The oil contains appreciable sooty insolubles, but their thickening effect has been more than offset by the diluent. On the basis of viscosity drop alone, dilution is estimated at 4%. Considering the offsetting effect of the insolubles however, it is probable that the true fuel dilution is nearer 7% or 8%.

The insolubles content has exceeded the safe solid contaminants load and the oil has been kept in service too long under the operating and service conditions of this engine. The insolubles are predominantly fuel soot, but the ash shows some engine metal wear particles and a trace of silicon. A drain schedule shorter than 3000 mi is indicated.

Silicon is undesirable due to its abrasive action. While the actual amount in this example is small, its presence and the particular metals found indicate that some dirt or dust is bypassing the engine air filter and entering the combustion chamber from which it is reaching the crankcase with blowby gases, slightly abrading cylinders, rings, and pistons in the process. A surprisingly large amount of dirt is in the air in some of our large cities. It has been said, for example, that in New York City there is a total dirt fall of 6 or 8 tons per sq mi per day.

The information conveyed by this sample suggests more frequent oil draining and/or oil filter replacement; closer attention to air cleaner maintenance and induction system condition; more attention to injectors to reduce probability of a smoky exhaust; attention to injector fuel connections to check for leaks; reduction if possible in the amount of engine idling which is a prime contributor to dilution.

The analysis under "Used Oil Sample No. 2" is characteristic of this same engine in high-speed, intercity bus service. No mechanical changes in the engine are necessary when used in this service. The oil has been in the engine for the same mileage as was sample No. 1. Analysis shows a slight drop in gravity and in flash point suggesting a minor amount of fuel dilution. But the presence of moderate insolubles has more than offset its effect on viscosity.

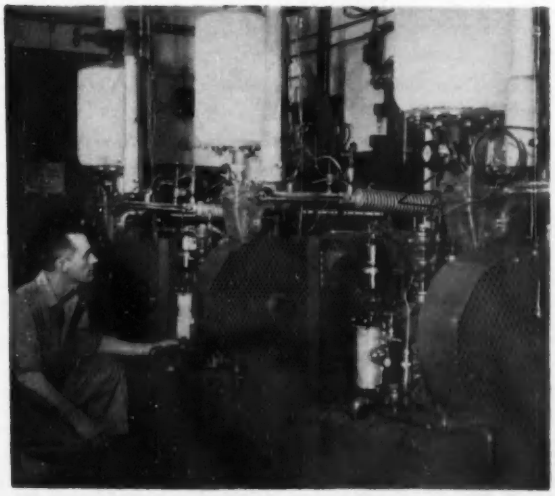
In other respects, insolubles indicate appreciably less sooty contamination and there is slightly lower ash. The sample indicates oil in suitable condition for extended service beyond the present 3000-mi drain schedule. In fact some bus fleets in this high-speed service with better than normal maintenance and good drivers are operating on a 12,000-mi drain schedule.

If the factors of engine design, operation, maintenance, and fuel are such that engine overhaul must be made at relatively short intervals, then it is necessary either to improve the unfavorable conditions among those four factors or to make changes in the fifth factor, the oil. Shortening the oil drain period is one immediate partial solution as is a change to an oil of different characteristics or improved quality. None of the steps can be regarded as a true remedy however.

The longer an engine is permitted to operate without attention to the indicated corrective measures, the more pressing will be the need for new pistons, rings, and cylinder sleeves; otherwise rapid engine wear with its attendant blowby will contaminate the oil severely, possibly to the point of a lubrication failure, because of a clogged oil screen or plugged oil lines. Ring sticking and breakage are also strong possibilities, with resultant burning of the piston top and wrecking of the engine.

Oil Quality

There are various identifications employed to differentiate engine oils, particularly for automotive use. In



Laboratory research with various fuels and lubricants and their effects when used in engines of different design is a never-ending task.

the former API classification system, three broad categories of oil types were recognized: regular, premium, and heavy duty.

One difficulty in this classification system was the interpretation of the heavy-duty type which thus gave rise to another system of designation, one based on an oil's ability to meet a government or manufacturer's performance specification. Using this method, various degrees of "heavy-duty", based on performance in the Caterpillar single-cylinder test engine, may be indicated in order of increasing detergency as follows: U. S. Army Specification 2-104B (no longer official); U. S. Military Specification MIL-L-2104A, Supplemental List 1; Supplemental List 2 (or Series 2).

The original API system classifying oil by type has now been superseded by a new API classification based on designs and service requirements of automotive engines. There are two classifications for diesel service, Services "DG" and "DS".

	New Oil	Used Oil Sample No. 1 From Automotive Engine After 3000 mi City Bus Service	Used Oil Sample No. 2 From Automotive Engine After 3000 mi Cross-country Bus Service
Gravity, API	27.4	28.4	27.1
Flash Point, F	420	415	420
Viscosity, SUS at 210 F	64	58	65
Estimated Fuel Dilution, %	0	4-8	trace
Color, ASTM	6	Black	Black
Insolubles in Pentane, Wt %	0	2.1	0.7
Insolubles in Benzene, Wt %	0	1.9	0.6
Ash, Wt%	0.65	0.65	0.72
In ash, spectrographic	Additives	Major Additives Minor: Iron, Aluminum Trace: Silicon	Major Additives Minor: Iron Trace Silicon
Neutralization Number	0.1	0.3	0.3
Water	0	trace	0

Table I Used Oil Analysis

For high-speed automotive-type diesels, "Service DG" is defined as service typical of diesels in any operation where there are no exceptionally severe requirements for wear or deposit control due to fuel or to engine design characteristics. "Service DS" is service typical of diesels operating under extremely severe conditions or having design characteristics or using fuel tending to produce abnormal wear or deposits.

As a rough relationship, oils of the MIL-L-2104A type or the Supplemental List 1 type are usually considered satisfactory for "Service DG". Series 2 oils are generally considered necessary for "Service DS."

The performance properties that the refiner tries to build into an oil are shown below. The order is not intended as any indication of importance as this will differ with both the engines and the nature of the service.

1. Engine wear reduction
2. Protection against ring and cylinder scuffing
3. Oxidation stability
4. Alloy bearing corrosion protection
5. Protection against high temperature piston deposits
6. Protection against high-load and high-temperature varnish and sludge
7. Protection against light-load and low-temperature varnish and sludge
8. Protection against valve deposits and promotion of extended valve life
9. Engine rust prevention
10. Assurance of proper ring and cylinder break-in
11. Cold starting ability
12. Low oil consumption

Of these 12 performance factors, only the third, fourth, fifth, and possibly the sixth are evaluated by the standard Caterpillar L-1 and Chevrolet L-4 tests required by the MIL-L-2104A specification. Engine laboratories would be fairly simple affairs if the proof-testing of new products stopped with these two tests. Many of the problems assigned to the lubricant for solution arise from such factors as high or low temperature, high load, inadequate lubricant flow, metallurgical limitations, and incompleteness of combustion.

Engine laboratories of the petroleum industry over a period of many years have developed many specialized test techniques for product evaluation. Several illustrations of the special engine-test facilities in the laboratories of the authors' company for the development of diesel engine oils are shown. Column 1 of Table I lists some characteristics for which tests are conducted.

Summary

The foregoing discussion has attempted to explain the importance of each of five factors involved in engine performance. When the four factors—engine design, operation, maintenance, and fuel—are ideal, lubricating oil will show to the best advantage. What the operator is seeking is the longest feasible operation, miles or hours, to overhaul. To attain the ideal it is necessary to minimize external contamination. Fuel characteristics must be such as to promote smoke-free operation. There must be good combustion (this depends on proper balancing and functioning of injectors as well as on the fuel). The crankcase must be maintained hot enough to prevent formation of low temperature sludges but not so hot as to promote high temperature varnish.

Under ideal conditions, relatively long crankcase drain periods are possible, but unfortunately the ideal condition rarely exists. Most operations depart from the ideal by imperfect removal of abrasive material from the air entering the engine, through improper combustion, by incomplete filtration, and in widely varying conditions of operation. The extent to which the operating conditions depart from the ideal governs the establishment of oil drain periods.

Parts Reconditioning

By D. R. Lammers

Service Manager, Caterpillar Tractor Co.

Installing valve seat inserts is a reconditioning practice which has proved both practical and economical in engine rebuilding.

NOW that new parts are available, owners should carefully consider the value of reworking worn parts. Many ingenious methods of rehabilitating worn parts have been practiced in recent years. Some of these salvage methods proved to be practical and economical, while others were expensive but necessary to keep badly needed units in operation.

Many reconditioning practices are so practical and have been universally used for so long that we forget to classify them as such. Among these are regrinding crankshafts and camshafts, etching or honing to break the glaze and raising the ridge in worn cylinder liners, using wider top compression rings on worn pistons, and installing valve seat inserts in cylinder heads.

Turning track pins and bushings and reboring and sleeving bearing bores in transmission cases and final drive covers should also be included.

The practices of hard-facing cutting edges and bucket teeth, straightening sheet metal guards and hoods, and building up with electric worn spots on heavy fabricated steel parts will remain popular because of their economical value.

Other practices have become common due to parts shortages in the past and will continue to be popular because they have proved to be practical. Included in this group are the building up of track grousers, track rollers, idlers, and sprockets, and regrinding track roller shafts, using undersige bushings.

Welding new rims on sprockets, building up the outside of worn steering clutch drums, or using extra-thick brake linings and installing clutch drive rings in flywheels have also become widely accepted.

Track links have been built up with electric welding rod which has been entirely successful, but the economy of this operation is questionable. The advisability of repairing track links by this method can best be determined by local experience.

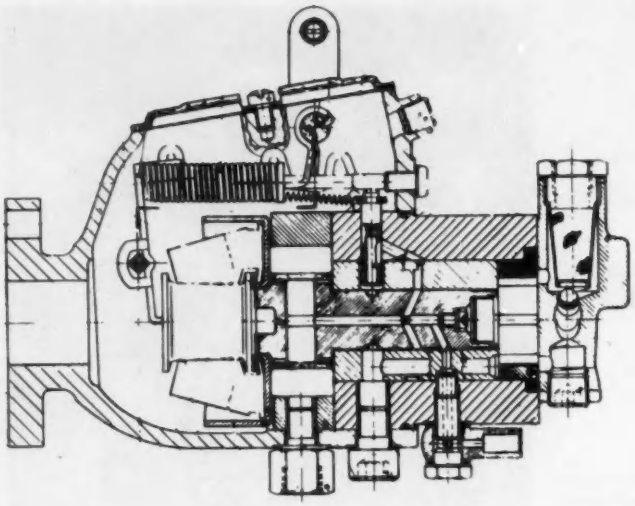
Obviously, if a part can be reconditioned for much less than the cost of a new part, and if the reconditioned part functions properly with a new life expectancy approaching that of a new part, the owner will prefer to have the part reconditioned. Many times, however, it will prove to be better to purchase new parts.

Some reconditioning procedures are practices which are believed to be definitely not advisable. Foremost among these is the repairing of Caterpillar fuel injection pumps. This frequently results in inaccurate fuel injection timing because of variations in dimensions of fuel pump bodies. Repairmen invariably neglect to compensate for these variations. The discrepancies in timing usually are not great enough to cause noticeable malfunction of the engine, but could easily nullify the saving by increasing the fuel consumption or rate of depreciation of other engine parts.

An owner will spend less for fuel injection pumps by buying new pumps only when the old pumps are worn enough to cause hard starting or a noticeable lack of power.

Regrinding crankshafts to intermediate undersizes is another example of false economy in reconditioning parts. It is recommended to use the shaft until it is worn enough that it should be reground to the standard undersize. Regrinding long before the crankshaft reaches this point is unnecessary and a waste of money. It also requires additional labor in the special fitting of bearings.

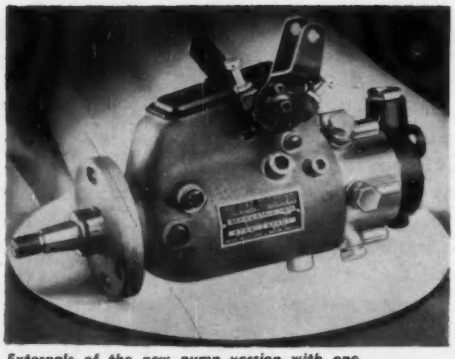
In summary, the practice of sound, economical parts reconditioning results in better and lower cost service for machine owners.



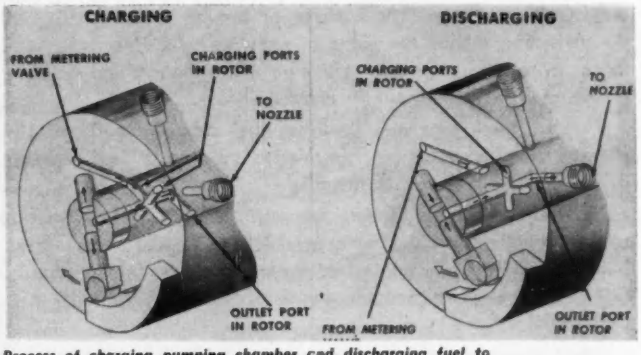
Internal rearrangement and a separate drive member (not shown) permit use of a single housing for all common mountings and drives.

RoosaMaster Fuel Injection Pump is Simplified

Details of how an already compact, simple fuel injection pump was made smaller, lighter, and further simplified. Performance levels have been maintained, flexibility of application increased, and manufacturing costs reduced.



Externals of the new pump version with one common type of drive member incorporated.



Process of charging pumping chamber and discharging fuel to injectors is automatically timed as pump rotor is turned.

FIELD experience has proven the practicality and functionalism of the RoosaMaster fuel injection pump. When it was introduced by the Hartford Machine Screw Company back in late 1952, it represented an advancement in compact, light-weight, simple, and relatively inexpensive fuel injection equipment. Now a new model has been introduced. Significantly, no changes have been made in the major pumping components or in the performance characteristics. These are essentially the same as were incorporated in the latest production models prior to the introduction of the new design.

Redesign was directed toward further progress in simplification, size and weight reduction, and lower cost—the bogy of injection equipment in general. Rearrangement of some internal parts and a unique drive system allowed a single housing to be used for all applications. This did the trick; only one standardized housing to make. After this major hurdle, it was possible to apply

engineering and cost analysis to other components.

Now, let's see what was done and how. But first. . .

A Review of Operation

Refer to the sectionalized drawings. Filtered fuel enters the vane-type, positive-displacement pump at the right. A bypass valve regulates delivery pressure. A passage leads the fuel to an annular groove around the shaft seen just below the metering valve. From here it has access to the metering valve. The position of the slot in the metering valve with respect to the charging hole will determine the size of the orifice through which fuel flows to the charging ports in the rotor. This is the point of metering.

As a charging port lines up with the passage (timed so that the plungers are ready to receive fuel), fuel flows to the pumping chamber through the central bore of the rotor. The plungers move outward to accommodate the amount of fuel metered. All of this fuel is delivered on the next pumping stroke.

When pumping is to begin, the plunger rollers contact the ramps of the internal cam ring. The charging ports will have passed out of the index with the charging passage and the outlet port will be in index with a passage leading to a high-pressure line and a nozzle. Fuel, pressurized as the plungers come together, is forced back through the rotor bore and out to the nozzle. This cycle recurs for each cylinder in accordance with the engine's firing order.

After the plungers complete their stroke, there is a slight dip in the cam, allowing them to retract slightly. This occurs while the discharge passages are still in registry and reduces the line pressure to stop any tendency to dribble. Limits are placed on outward plunger movement for two reasons. First, the rollers are not intended to maintain contact throughout the cam ring. They ride free after rolling down the decelration ramp, relieving pressures and allowing oil films to re-establish themselves. Secondly, restraint of outward travel acts as a maximum fuel or smoke limit control. Earmark these points for later discussion.

A simple mechanical governor controls engine speeds. The only force required is that needed to turn the metering valve. Friction is eliminated to a maximum degree by using knife-edges as fulcrum points in place of links, pins, etc. For example, flyweights pivot on one corner, shaped to an acute angle, that bears on the governor weight retainer. The result is excellent sensitivity of control.

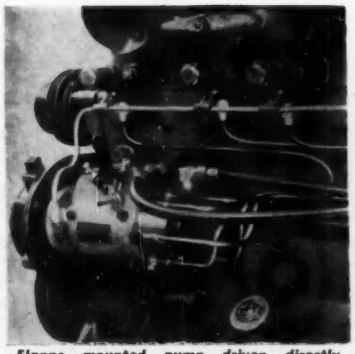
A small bleed passage from the annulus supplying fuel to the metering valve fills the governor area with fuel. This lubricates the cam, cam rollers, and shoes, as well as the governing mechanism. A small vent line avoids air pockets and undue pressure buildup by bleeding oil back to the supply tank. Since pressures are higher in the pumping and distributing mechanism than they are in the housing, no back-flow can occur.

These are the essentials of pump operation. No mention has been made of the drive, and since this is a very important feature of the new pump model, let's look at. . .

The New Driving Arrangement

Each engine manufacturer has his own idea on pump drive. Some want an external coupling drive; some want a flange mounting with an intergral drive gear on the shaft; others want shank mounting. Ordinarily each of these—and there are many other variations—means a special housing. The new Roosa pump solves this by what amounts to a separation of the pump into two components—the pumping and governing mechanism in a housing, and the drive shaft.

In order to do this, rearrangement of some internal parts was necessary. For this part of the discussion, it is enough to say that the governor, previously supported on the drive shaft, was attached to the distributor rotor. More on this later. By freeing the drive shaft of all jobs but its main function, a good deal of design flexibility was made possible.



Flange mounted pump driven directly by gear meshed in engine's gear train.

Pump is slipped off drive member leaving driving mechanism intact and in time.

Typical drive shaft shows relief for cup seals and off-center hole for timing pin.

To oversimplify, the drive shaft now becomes a piece of shafting with a squared tang that extends into the pump, engages the distributor rotor, and turns it. The shaft can stay with the pump or the pump can be slipped off the shaft, leaving it as part of the engine. This illustrates the flexibility that allows a single housing to be used.

Take one of the most troublesome cases in which the pump is driven directly from its gear in the gear train. In the past, the opening in the gear case had to be big enough for entry of the integral gear. Timing mark matching was involved and the pump housing generally incorporated a flange big enough to close up the hole. Now the shaft is keyed in the gear, timing set when the gear train is set up, and the hole required is only big enough for shaft clearance.

In most cases both the hole clearance and the gear case do not leave enough room for the gear to drop out of mesh when the pump is removed. When replaced, it is slipped over the shaft, the tang properly engaged, and the holding bolts made up. The possibility of being 180 deg out of time is avoided by use of an off-center pin in the end of the shaft.

The standard housing flange has four elongated bolt holes. Three are 120 deg apart for 3-bolt mounting and the fourth is 180 deg from the top hole for 2-bolt mounting. The flange has graduations for alignment with an index mark on the gear case. These with the elongated holes permit the housing to be rotated slightly for "less-than-tooth" timing adjustments.

Pumps can be supplied with or without shafts. Hartford will make them, or the engine builder can do so. Dimensions are specified, including the recess for two cup-type oil seals mounted on the shaft to stop leakage either way. In this way, coupling, gear, and shank mountings are all possible. Incidentally, shaft diameter was figured to permit standard SAE pilots for shank-mounted pumps.

Now for discussion of. . .

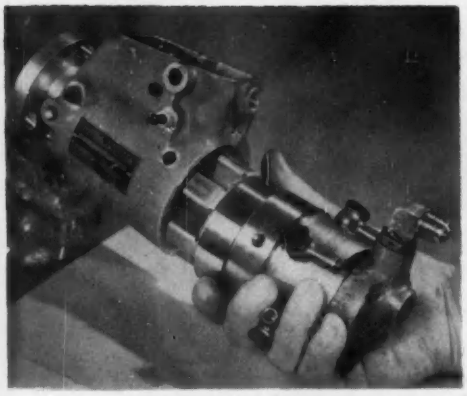
Internal Changes

Earlier RoosaMaster pumps had a top and bottom adjusting plate, one on each side of the pumping portion of the distributor rotor. These plates were coupled by tangs to move together. They limited maximum fuel delivery by restraining outward movement of the plungers. Internal cam surfaces engaged cammed projections on the roller shoes. Rotary movement increased or decreased the stroke.

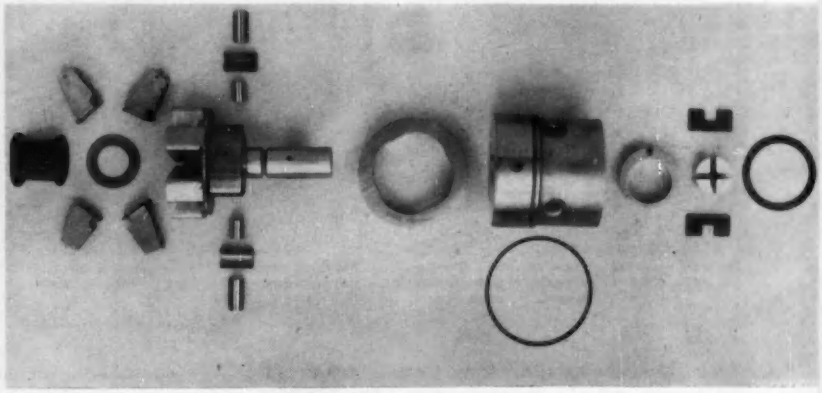
These plates were locked to the distributor rotor by a drive plate. This had an internal spline into which the drive shaft fitted. All gone now.

Maximum stroke is now controlled by the simple spring pack illustrated. The ends of the bottom spring leaf, seen extending over the milled slot, limit outward movement of the cam roller shoe and hence the stroke. Flattening out the spring (tightening the screw), increases the stroke and vice versa. A slot in the distributor rotor is the point of engagement with the drive shaft.

This redesign eliminated the two adjusting plates and the drive plate. A simple spring pack was substituted. Also, cam roller shoes were greatly simplified by doing away with the cam-ground projections. This change then made it possible to back the governor weight retainer right on the distributor rotor. This retainer for-



Transfer pump, hydraulic head with rotor, and governor form single compact assembly.



Components (R to L) are transfer pump parts; hydraulic head and seal; cam ring; rotor with plungers, shoes, rollers, attached governor weight retainer; weights and sleeve.

merly consisted of a number of stampings, spot-welded together. Now it is a single-piece stamping and a very neat job it is too.

Governor weights were redesigned to be stampings. Blanks are formed to give the required shapes, after which slugs of the proper weight are spot-welded to their outer ends. During manufacture, these can be easily made up with slugs of different weights to suit different governing requirements. The principle of knife-edge pivoting was retained; in fact, carried further.

Toes of the weights engage the governor sleeve with line contact. The same is true of the governor arm which itself pivots on a knife-edge. In earlier models, the governor spring was in tension, but now that the position of the governor assembly has been reversed, it is in compression. This is an advantage as it gives greater sensitivity over a broader range of speeds.

Every part of the simple governor linkage is a stamping, and as in past models, light linkage springs are used to take up all slack. A variety of governing characteristics are possible by changing the weights and the control springs.

This covers the major internal changes, but one thing more for discussion is the. . . .

Automatic Timing Feature

"Timing" as used here does not refer to basic pump timing but to advance and retard of timing with engine speed. This is done by shifting the cam ring in the housing. This is normally retained in a fixed position, but when variable timing is desired, a fitting ending in a ball extends from the ring through the bottom of the housing. The ball is engaged by an assembly attached to the housing in which a piston is hydraulically actuated in one direction against spring tension.

Remember earlier mention that the rollers did not always bear on the cams? Well, this is why relatively little force is needed to shift the ring's position. Movement occurs during the "free" periods when only the friction of the ring in the housing must be overcome. Hydraulic pressure, varied by engine speed, moves the ring by piston action on the ball fitting. When oil pressure is relieved, spring pressure aided by the force of the rollers on the cams pushes back the piston.

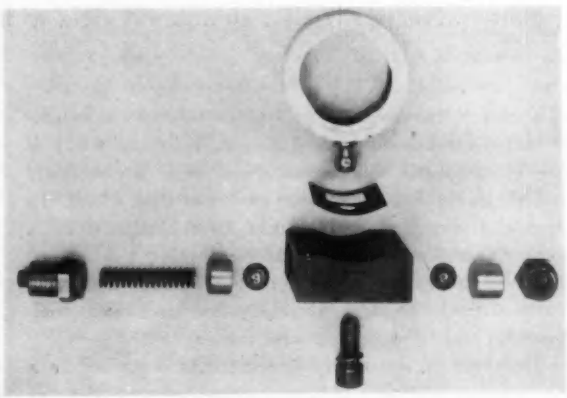
This covers all the major points and leaves nothing more but a . . . .

Summary

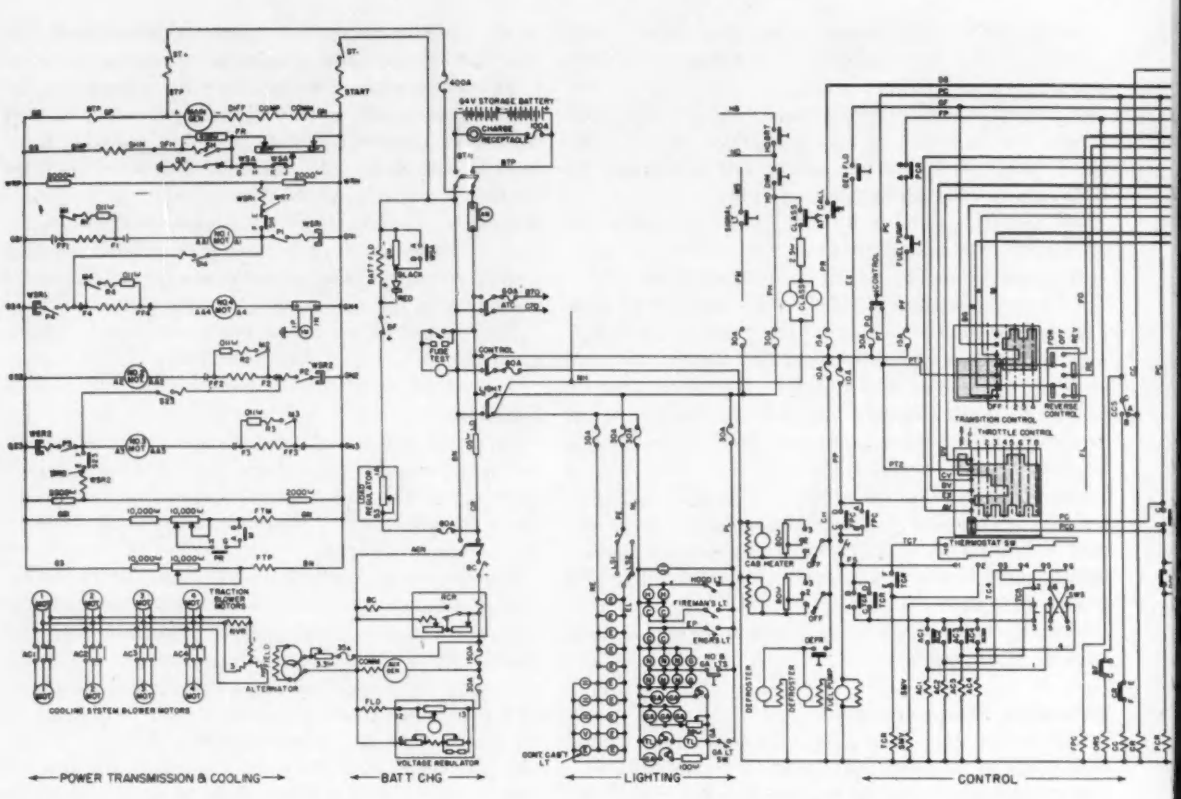
By means of a unique driving system it has been possible to standardize on a single type of housing for all applications. This means greater production runs which raises the possibility of cheaper manufacturing methods, for example, die casting.

Rearrangement and redesign of some internal components resulted in elimination of some parts and simplification of others. It all adds up to reductions in size and weight—and lower cost of manufacture.

All this has been done without sacrifice in performance or flexibility in application. It can be adapted to practically any type of drive and both directions of rotation. It comes in 2-, 3-, 4-, 6-, and 8-cyl versions for both 2- and 4-cycle engines. Eight plunger sizes from 0.250-in to 0.390-in, in 0.020-in steps, will accommodate a wide range of engines with the largest supplying the needs of engines of about 115-cu in displacement per cylinder.



Left, rotor details with plungers, shoes and rollers. Spring pack adjustment (note lip on inner leaf) limits shoe and hence plunger travel. Above, details of hydraulic mechanism for timing advance.



Tracing A Schematic Wiring Diagram

Complex wiring diagrams are generally just a composite of several simple circuits. Pick the circuit you want to trace and isolate it. Practically all diagrams will yield to this technique.

IN correct terminology the type of locomotive in predominant use on most American railroads today is the diesel-electric rather than diesel as it is commonly called. Its equipment is more electrical than diesel. To review, a diesel engine drives a direct-connected main generator and auxiliary generators. Electricity developed by these generators is used to operate the remaining parts of the locomotive excepting some mechanical components, mostly associated with the engine.

This type of locomotive is sometimes described as a complicated assembly of intricate mechanisms. Most of us will agree with this definition, or at least we did on first impressions. Remember, if you will, when you first took a look around inside an engine room, looked at the builders' manuals, and at a typical wiring diagram with its confusing network of wires and symbols.

The mystery of its operation and the uncertainty of what to do when it fails to function in some part or entirety, seems to be concerned largely with the electrical components. Here lies the potential source of many difficulties. Therefore the ability of both operating and maintenance personnel to quickly "trouble shoot" electrical difficulties is most important.

The operator's abilities should include the knowledge of basic trouble shooting for replacing fuses or minor repairs enroute as well as the correct handling of locomotive operating controls. He should be competent also to intelligently report in writing (on work report forms) facts regarding malfunctioning of devices and parts to maintenance supervision at terminals. The maintainer or repairman should be able to inspect, test, locate, and repair defects in parts causing trouble even if the operator's reports are somewhat vague and inadequate as is the case many times.

In view of this, the ability to trace a schematic wiring diagram is a tremendous asset. This knowledge will en-

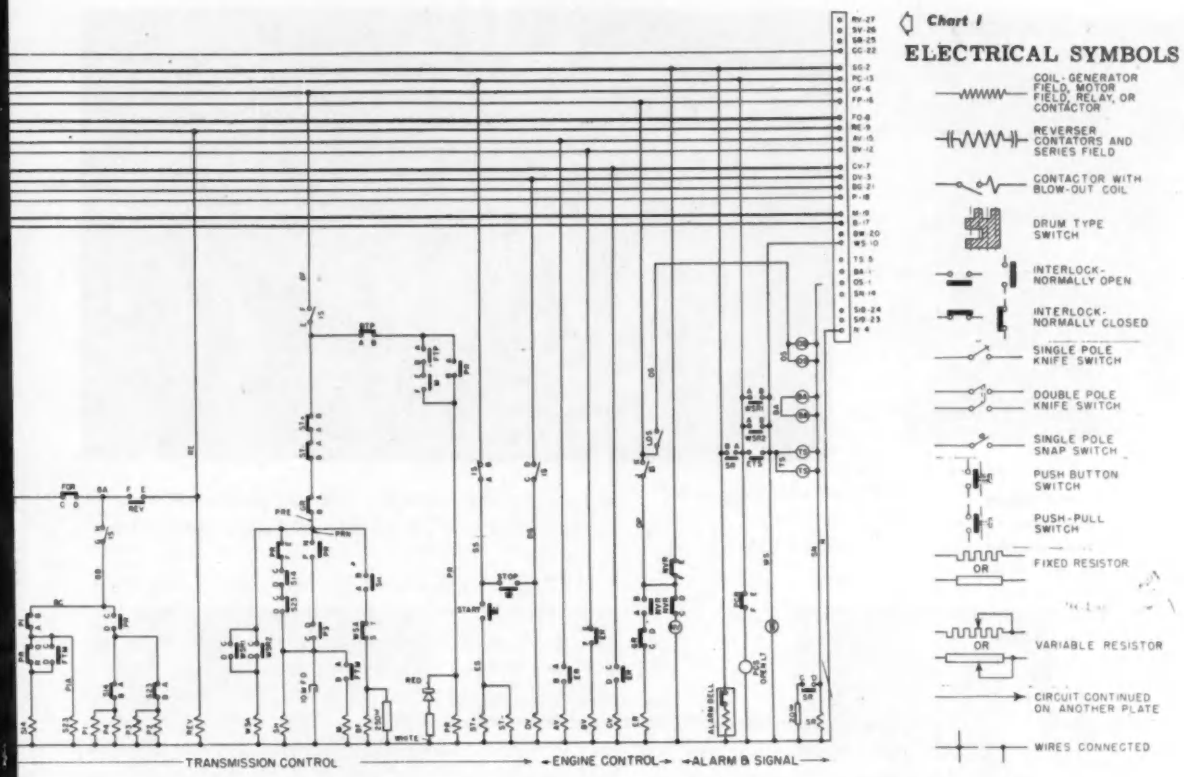


Chart I

ELECTRICAL SYMBOLS

able interested personnel to have a better understanding of how the various components of the locomotive work and to check wiring connections on equipment and control panels. Thus existing defects can be quickly found and remedied.

Remember These Facts

In studying a schematic wiring diagram so that it makes sense, you will find it pays to always *remember*

1. that contactors, switches, and relays are shown on the diagrams, de-energized (normal positions) as if the engine were stopped, with all manual switches shown open.

2. that when the operating coil of a relay or contactor becomes energized, the interlocks and contacts associated with that relay or contactor change, and will then be in a position opposite to that shown in the diagram.

3. when tracing a circuit, just which interlocks and contactors have changed from *normal* positions due to actuating relay coil having been energized or possibly changed back to *normal* because of relay coil having been de-energized in previous sequential steps.

4. that *start* is the *normal* position of the isolation switch (IS) with finger contact AB of IS closed in the engine starting circuit, and all other IS finger contacts open as shown on the wiring diagram. Actually all of these contacts are in the opposite positions after engine starting as IS is then changed manually to the *run* position.

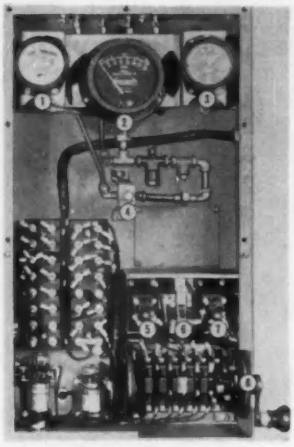
5. that interlocks and contactors in most instances are shown in other circuits and in different locations on diagram from that of the relay coil which actuates them.

6. also, a familiar elementary fact that electricity will flow from a source such as a battery or generator to one or more devices to be operated and back to source only when all switches, contactors, and interlocks are closed in the circuits involved.

In addition, note on the diagrams that the bottom line represents a common wire return to the source. Many devices are connected to this wire. Therefore it will not be necessary to trace all circuits back to source.

INTERLOCKS—and their identification need some explanation. An interlock is not an individual piece of equipment apart by itself. It is a part of some relay or contactor actuated by that device and used to control a circuit. Identification of interlocks are by designations such as AB of SH, which means AB interlock of Shunt Field Contactor. A contactor or relay may have several interlocks, in which case additional letters are added like CD-EF-GH and so on. Some interlocks are shown open and others closed when their controlling contactor is open. Thus they are referred to as *normally closed* or *normally open.*

Main contacts of the various contactors are identified



Engine Control and Instrument Panel

1. *Lube oil suction gauge*
2. *Fuel oil level gauge*
3. *Lube oil press. gauge*
4. *Fuel gauge push button*
5. *Engine "stop" button*
6. *Fuel pump motor switch*
7. *Engine "start" button*
8. *Isolation switch*

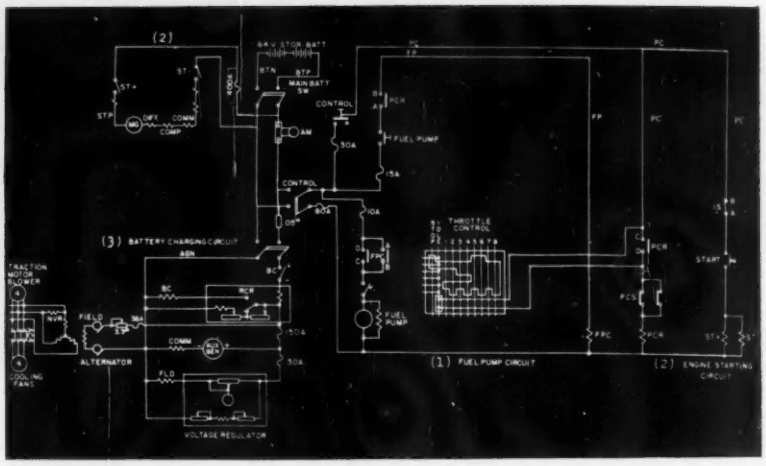


Chart II

on diagrams by symbols and legends (see tabulation of symbols and legends.) The same legends are used to identify the actuating relay coils and the corresponding main contacts. For example, "ST+" and "ST—" identify starting relay coils, and also "ST+" and "ST—" at upper left on the engine starting diagram identify starting contacts. Main contacts are shown on diagrams in fairly close proximity to the symbol of the field or device energized by them. General location on diagram is indicated as the various contacts are mentioned in the text.

Seven Important Circuits Traced

There are seven primary electrical circuits essential to diesel-electric locomotive operation. These are (1) Fuel Pump, (2) Engine Starting, (3) Auxiliary Generator and Battery Charging (includes cooling fans for engine temperature control and traction motor blower fans), (4) Locomotive Control, (5) Generator Excitation, (6) Engine Speed Control, and (7) Transition.

CHART I is the complete schematic wiring diagram for the EMD Model F7, non-dynamic "A" unit and includes the seven primary circuits mentioned. Lighting, temperature control, and alarm and signal circuits are shown in Chart I only. At first glance, this complete diagram with its maze of wires and symbols seems confusing and some explanation is necessary. This is best done by analyzing the various important circuits individually in the order shown above.

CHART II combines the first three individual circuits: (1) Fuel Pump; (2) Engine Starting; and (3) Auxiliary Generator and Battery Charging. Before starting to trace these circuits we should consider that the main battery and control knife switches and two pushbutton switches —control and fuel pump, have all been closed manually in the cab.

(1) Fuel Pump—circuit is simple and consists of two parts, a control and an operating portion. The control portion of circuit starts at the positive side of battery and goes through main battery and control switches—ammeter shunt between, through a 30A fuse, control pushbutton switch, and comes out on PC wire which runs throughout locomotive. A connection from this PC wire goes to the throttle stand where contact is made by fingers (at which wires terminate) touching a metal bar on the throttle drum, when the throttle is in the *idle* position.

This permits continuation of circuit to PCS contacts, and through the PCR coil. Note that when PCR coil is energized, CD interlock of PCR closes, establishing a holding circuit, so the PCR coil will stay energized after throttle is opened. Note also that PCS contacts will stay closed unless PCS, an air operated electric switch, is tripped by either a penalty air brake application such as is caused by removal of engineers foot from the "Dead Man" pedal, operation of locomotive overspeed, or some other train control device. From PCR coil the circuit is completed through an 80A control fuse, the main battery and control knife switches back to the negative side of the battery.

The fuel pump operating portion of the circuit continues from positive wire of main control knife switch through a 15A fuse, the fuel pump pushbutton switch, through AB of PCR (now closed), and out the FP wire which runs throughout locomotive. A connection from the FP train line wire, leads to FPC coil, the energization of which closes interlocks AB and CD of FPC in fuel pump motor circuit. Another positive control wire goes from the main control knife switch through a 10A fuel pump motor fuse, and AB and CD contacts of FPC to the fuel pump toggle switch (as indicated on diagram). The manual closing of this switch completes the circuit, and the fuel pump should then be operating.

(2) Engine Starting Circuit—is next in the sequence. The control portion of this circuit is in common with the fuel pump control circuit, continuing along PC wire. A tap from PC trainline wire goes to AB of IS finger contact. As the spring loaded pushbutton *start* switch is pushed in, the circuit goes to starting contactor coils ST+ and ST—.

In the operating portion of this cricuit the starting contactors ST+ and ST— (located in upper left on diagram) close, because of energization of coils ST+ and ST— in the control circuit. Battery current then flows from a positive wire connection just beyond the main battery switch through a 400A starting fuse, the ST+ contactor, the main generator armature (MG), on through differential (DIFF), compensating (COMP), commutating (COMM) fields, through main generator starting field, the ST— contactor, and back to the negative side of the battery. The main generator, now acting as a motor, cranks and starts the diesel engine. Now the starting button may be released breaking the circuit to ST+ and ST— coils. This allows the starting contactors to open, disconnecting the main generator from the battery.

(3) Auxiliary Generator and Battery Charging Circuit—includes several auxiliary electrical equipment devices, which function as outlined below. As the engine starts running, the auxiliary generator begins to furnish low voltage current for battery charging and the low voltage system of the locomotive.

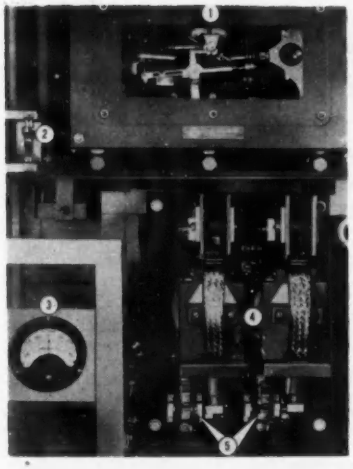
Voltage regulator receives current from the positive side of auxiliary generator through a 30A fuse. Current divides into two paths, the first goes through the regulator variable resistor and auxiliary generator field (FLD), while the second path follows a lead through two variable resistors and the interposed regulator field winding to regulate voltage output. These two paths then combine and lead back through COMM field to auxiliary generator negative.

Reverse current relay (RCR) receives current from the positive side of the auxiliary generator through a 150A generator output fuse. At first the flow is through a spring loaded finger, a variable resistor, and a voltage coil from which it continues through COMM back to generator negative. When proper voltage is reached, the voltage coil will pull the spring loaded finger to the opposite contact, completing a circuit through battery charging coil BC.

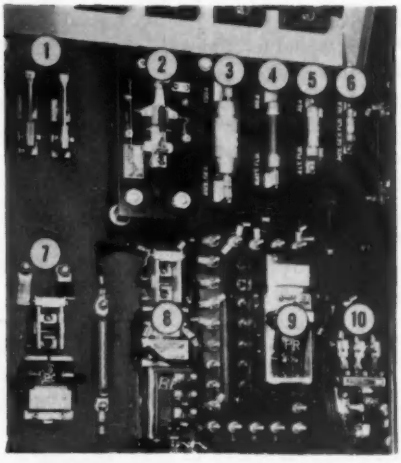
Battery charging contactor (BC) closes when BC coil is energized. This action provides a current path through current coil RCR, BC contactor, the auxiliary generator knife switch (previously closed manually), a .05 ohm charging resistor, the ammeter shunt, and the main battery switch to the positive side of the battery. Return flow is from battery negative through the two knife switches to auxiliary generator negative (AGN).

Whenever auxiliary generator voltage falls below a specified amount, tending to reverse the flow from battery through RCR, the spring pulls the finger back, breaking the circuit through BC coil, thus opening BC contacts. This disconnects the battery and prevents battery current from motoring and damaging the auxiliary generator, and also needlessly exhausting the battery.

Alternator excitation is another important function of the auxiliary generator. This is done by current flowing through the 150A fuse, a 35A alternator field fuse, a 3.3 ohm resistor, and the slip rings connecting to the rotor field, exciting it, and then return to generator negative. A 3-phase alternating current is induced and used to operate the traction motor blowers and engine cooling fans. In case of an alternator failure, the NVR (No AC voltage relay—on low voltage panel) drops out and causes the alarm bell to ring in all units. It also actuates a blue (warning) light and reduces the engine speed to idle in the unit affected (except if throttle is in 5th or 6th notch where the engine will stop), should AC output fail.



Voltage Regulator and Starting Contactor Panels
1. *Voltage regulator*
2. *Engine room light switch*
3. *Battery ammeter*
4. *Engine starting contactors*
5. *Starting contactor interlocks*



Low Voltage Panel
1. *Auxiliary generator switch*
2. *Reverse current relay (RCR)*
3. *Battery charging fuse (150 amp)*
4. *Battery field fuse (80 amp)*
5. *Alternator fiesl fuse (35 amp)*
6. *Aux. Gen. field fuse (30 amp)*
7. *Battery charging Contactor (BC)*
8. *Battery field contactor (BF)*
9. *Parallel relay (PR)*
10. *No Voltage relay (NVR)*

CHART III, combines two separate circuits, (4) Locomotive Control, and (5) Generator Excitation.

(4) Locomotive Control—is the next step and connects the traction motors to the main generator. Control portion of this circuit is in common with the main control circuit from battery positive to the control pushbutton switch. From the right side of the pushbutton switch the circuit goes down the PT2 wire to a point where a finger contacts metal on the throttle drum. When throttle is opened to No. 1 position, this drum moves left sliding under EX finger, completing the circuit on EX wire to the generator field pushbutton switch in the cab. Closing this switch (usually done before opening the throttle) sends current out GF wire, which runs length of locomotive.

A tap from GF wire goes to a finger on the transition control drum. (All fingers on both transition and reverse drums are shown resting on insulation.) As transition lever is moved to No. 1 power position, the metal control drum contact slides under the GF wire finger and under another finger below which is connected to the reverse drum. As the reverse lever is moved to the forward position "FOR" a metal bar on reverse drum slides under the center and top fingers, completing the circuit through these two controls and out on FO wire. Current now will flow through FO wire to FOR coil, causing the electropneumatic operated reverser, in high voltage circuit, to move to the forward position.

A tap off FO wire before the FOR coil goes through interlock CD of reverser FOR, HG of IS (now closed), interlocks AB of P1 and QR of PR (both normally closed) to S14 coil, and from a connection between the two interlocks to S23 coil.

The operating portion of this control circuit is in the high voltage system (left side of diagram). It starts with the series contactors which close due to energization of coils S14 and S23. The circuit may be traced from main generator positive (at upper left) down the terminal GS1, through reverser contacts and motor field to No. 1 motor armature, through S14 contactor, through reverser, field and armature of No. 4 motor, load indicating meter IM shunt to terminal GN4, and back through generator fields to negative side of generator.

A similar circuit connecting traction motors Nos. 2 and 3 to the main generator starts at terminal GS2, and goes through S23 contactor to terminal GN3. The traction motors are now in series-parallel connections across the main generator. This is the first of four motor connections, as explained under transition circuit No. (7).

(5) Generator Excitation is the next step so that main generator will start putting out power, and is accomplished by the following circuits. Another connection from GF wire (already energized by circuit No. 4), goes through EF of IS (now closed), normally closed interlocks AB of ST—, AB of ST—, AB of GR, EF of PR, CD of S14 and CD of S23 (both now closed), then to SH coil, completing the control portion of this circuit.

Operating portion of the generator excitation circuit, starts with the closing of shunt field contactor SH in the main generator circuit (shown at left side of diagram). This is actuated by energization of SH coil.

The shunt field circuit comes from the positive side of the main generator armature to first connection, then through shunt field windings, indicated between SHP and SHN, through SH contactor, GH of WSA, JK of WSA, and then through a 53 ohm limiting resistor to a connection leading back through main generator fields to its negative side.

Now back to the right side of diagram. Just below AB of GR another connection leads through AB of SH (now closed), and TS of WSA to BF coil, the energization of which closes battery field contactor. This contactor is shown at left side of low voltage diagram, just above the load regulator.

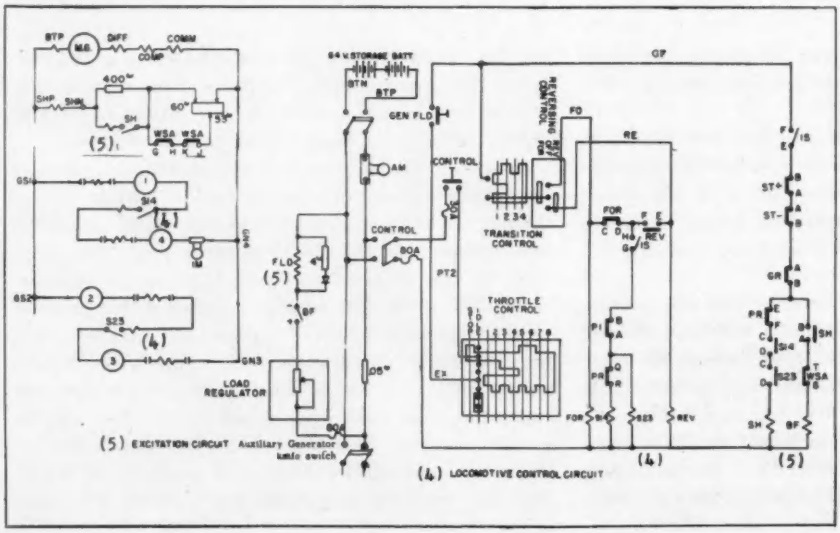


Chart III

The load regulator is in series with the battery field through the battery field contactor, as will be noted. Actuated by the governor, it functions automatically in varying battery field strength in the main generator, to maintain a constant horsepower output, corresponding to a definite rate of fuel consumption as determined by the throttle position.

The load regulator circuit starts at the battery positive in common with other circuits already traced, following the one leading to the auxiliary generator and battery charging circuit (No. 3) to a point just above the auxiliary generator knife switch. Here a connection leads through an 80A battery field fuse, the load regulator, BF contactor, battery field windings of main generator, then through main battery switch to battery negative.

Battery field (FLD) of the main generator, indicated above BF contactor, is now excited, and together with the excitation of shunt field as outlined above, completes main generator excitation, and the locomotive begins to develop power.

CHART IV—Engine speed regulation is covered in this diagram.

(6) ENGINE SPEED CONTROL circuit follows in the sequence to obtain maximum power of generator at various engine speeds, according to the different throttle positions, through electrical control of governor and its mechanical connection to the injector fuel racks.

Circuits DV, AV, BV, CV, and ER make up this portion. ER relay circuit is of primary importance as it must be established before the governor circuit can be effective. Starting with another tap from FP train line wire, this circuit goes through JK of IS (now closed), AB of NVR (now closed—but open if engine was not running, or alternator not producing AC), CD of GR to ER coil.

This coil when energized closes contacts AB, CD, and EF of ER interlocks in AV, CV, and BV governor speed control circuits. ER coil will become de-energized by isolation switch if it is not fully in the *run* position, by opening of AB of NVR if AC supply fails, or by CD of GR opening in case ground relay is tripped.

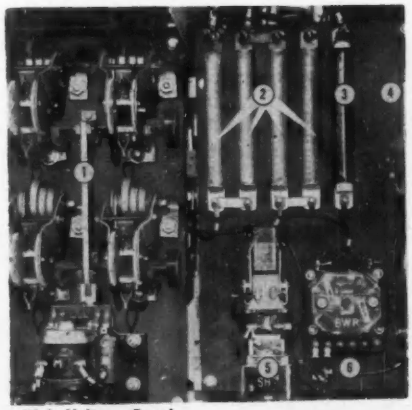
Either of these conditions will open all ER interlocks. This would bring the engine to *idle* with throttle in any position except 5 or 6, in which case DV coil will be energized and the engine stopped. This is because energization of DV coil (only), in the "D" solenoid in governor, brings injector fuel racks to "no fuel" position.

As throttle is moved from idle to positions 1 to 8, the metal plate on throttle drum moves to left sliding under contact fingers, completing circuits in different combinations. The effect on engine speed by energization of coils AV, BV, CV, and DV in governor solenoids "A", "B", "C", and "D" is shown in the following table.

Engine Speed Chart

Throttle Position	Solenoids Energized A	B	C	D	Engine Speed (RPM)
STOP (OFF)				*	STOP
IDLE			NONE		275
1			NONE		275
2	*				350
3			*		425
4	*		*		500
5		*	*	*	575
6	*	*	*	*	650
7		*	*		725
8	*	*	*		800
Effect of Solenoids on Engine RPM	+75	±300	+150	−150	(or Stop)

Engine may be stopped, when isolation switch is in *start* position by pressing *stop* button on engine control panel, as current will then flow from AB of IS to DV coil thus energizing "D" stop solenoid in governor. Placing throttle in STOP position, also stops the engine through energization of DV circuit, when "IS" is in *run* position.



High Voltage Panel
1. ***Traction motor field shunting contactors (M)***
2. ***4—2000 ohm wheel slip relay resistors***
3. ***Generator shunt field discharge resistor***
4. ***Ground protective relay knife switch (sealed)***
5. ***Generator shunt field contactor (SH)***
6. ***Dynamic brake warning relay (BWR)***

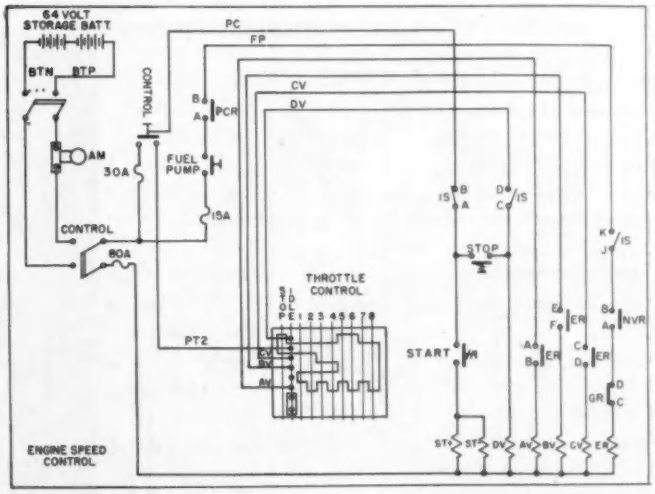


Chart IV

CHART No. V, deals with three-relay automatic transition

(7) TRANSITION is a term applied to changing traction motor connections on a diesel-electric locomotive, so that full power may be obtained from the main generator within the range of its current and voltage limits. Looking at it another way, transition is a method of adjusting traction motor "back pressure" (counter electro-motive-force) developed by motors, which opposes the input of power from the main generator, so that this counter e.m.f. will not become too high at higher speeds nor too low at lower speeds.

When not rotating the traction motors have practically no "back pressure" (resistance) to current from the main generator.

Series-parallel traction motor connections with the main generator were set up when the thottle was moved from Idle to Run 1 position (Circuit No. 4). After the train is started and as the locomotive speed increases, the "back pressure" of the traction motor builds up and makes necessary an increase in the main generator "pressure" (voltage) so that it can continue forcing current into the motors.

Although main generator voltage can be varied over a wide range, there is a practical operating limit to its ability to increase this voltage. If this practical voltage limit were exceeded, main generator power output, and correspondingly that of the engine, would drop off. To prevent this loss of power, a change is made in the electrical circuit just before the drop off begins.

Series-parallel-shunt, therefore is initiated when main generator voltage reaches 930v, as current will then flow in the high voltage circuit from the positive side of the main generator through a fixed 10,000 ohm resistor, a variable 10,000 ohm resistor and FTM coil back through generator fields to negative side of generator.

Energization of FTM coil acts to close two interlocks in the low voltage circuit. One is in the excitation circuit, where just above SH coil a connection goes through AB of FTM to M coil, which closes motor field shunting contacts M1, M2, M3, M4, in the high voltage circuit.

This shunting of some current around the motor fields, reduces the counter e.m.f. and thus lowers the main generator voltage. The other FTM interlock is in the control circuit above S14 coil, where between P1 and PR interlocks a connection goes to CD of FTM (now closed) establishing a holding circuit used in the next transition step.

Parallel connection across the main generator is the next step. This is more complex, and where the third "Remember" comes in handy, in knowing just which contacts have changed from *normal* or perhaps back to *normal*, due to previous sequence steps.

During operation in the series-parallel-shunt motor connections, the main generator voltage again increases. When it reaches 950 v the flow will then be from positive generator lead through two 10,000 ohm resistors, one fixed the other variable, through FTP coil (shown at bottom of high voltage diagram) then back to generator through negative lead. Energization of FTP coil results in completion of a circuit from EF of IS (now closed) —in upper right of diagram, through AB of BTP, then through AB of FTP (just closed), EF of M (previously closed by M), and to PR coil, thus energizing it.

The several PR interlocks now all change position, initiating action of various coils, contactors, and interlocks, the combined functions of which makes the parallel connections in the following sequence:

AB of PR closes establishing a holding circuit to keep PR energized. Removal of main generator excitation is accomplished by: (a) EF of PR opening, breaking circuit, dropping out SH coil and contactor, (b) AB of SH then opens, dropping out BF coil and contactor. The main generator voltage thus decays (necessary for opening of power contactors), decreasing to the drop out value of 700 v for FTM and 630 v for FTP.

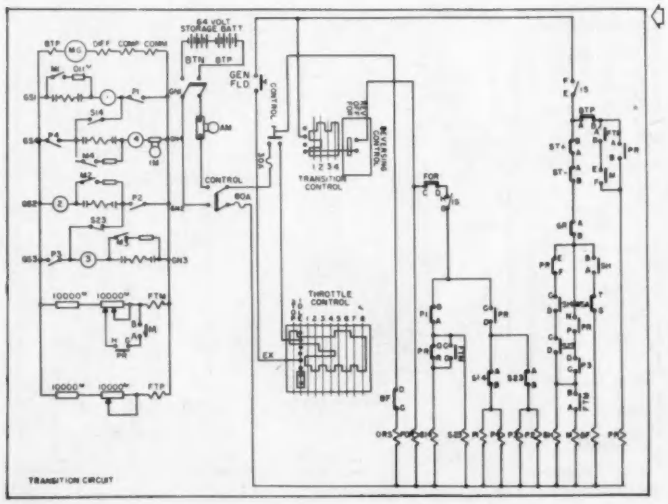


Chart V

LEGEND

AV, BV, CV, DV	Governor Control Solenoids
BTP	Backward Transition Relay
ER	ER Relay
FOR	Reverser Magnet Valve-Forward
FPC	Fuel Pump Contactor
GR	Ground Relay
M	Motor Shunting Magnet Valve
M1, M2, M3, M4	Motor Field Shunting Contactors
P1, P2, P3, P4	Parallel Contactors
PCR	Pneumatic Control Relay
PCS	Pneumatic Control Switch
PR	Parallel Relay
REV	Reverser Magnet Valve-Reverse
RVR	Reverser
S14, S23	Series-Parallel Contactors
WSA	Wheel Slip Auxiliary Relay

Power contactors then shift as follows:

(c) Shunting contactors ("M") are dropped out by opening of AB of FTM.

(d) S14 contactor is dropped out by opening of CD of FTM and RQ of PR (already open) de-energizing S14 coil, then S23 coil and contactor are dropped out by opening of AB of P1 interlock, because of bringing in the parallel contactors, next explained.

(e) The control circuit is now fed through CD of PR (closed by PR), AB of S14 (just closed), to P1 and P4 coils which close P1 and P4 contactors in the high voltage circuit. P3 and P2 contactors are brought in by energizing P3 and P2 coils through a circuit from a connection just below CD of PR, and through AB of S23 interlock, which was moved to its normally closed position by the opening of S23 contactor.

Re-establishing the excitation circuit (now that all motors are in parallel) is next accomplished similar to previous explanation, except that now the circuit from AB of GR goes through NP of PR (previously closed by PR), CD of P3 (now closed), to SH coil. This brings in SH contactor, while AB of SH interlock closes bringing in BF coil and contactor.

Parallel-shunt motor connections are necessary to attain maximum locomotive speed. This transition is accomplished when main generator voltage again increases to 930 v. when FTM picks up as it did previously. This causes AB of FTM to close bringing in M coil and the four M contactors—M1, M2, M3, and M4. This is the last stage of forward transition.

Backward Transition—As the locomotive slows down from maximum speed, due to an ascending grade, main generator voltage drops and main generator amperage increases. In order to limit these voltage-current variations, prevent high current damage to the motors, and maintain voltage high enough for efficient operation, a backward transition must be made.

Parallel transition backward from parallel-shunt connections is the first step. You will note on diagram that in the main generator circuit feeding current through two 10,000 ohm resistors, that the variable resistor has been shunted by closure of GH of PR, and AB of M, in the last forward transition stage. This lowers the drop out value of FTM coil from the previous 700 v to 600 v, at which value AB of FTM opens dropping out M coil and the four M shunt contactors. While this is below the drop out value of FTP coil which brought in the parallel contactors, they remain in as AB of PR remains closed, maintaining the PR holding circuit.

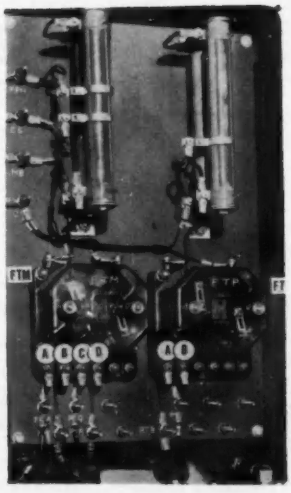
Series-parallel backward transition from parallel necessitates breaking the circuit to PR coil. This is done by BTP relay coil, which is located on the diagram just to the left of the positive side of the main generator, so that the full generator current flows through it. As the locomotive slows down again, the voltage drops and the amperage rises to the pick up value of relay (BTP), approximately 2250 amp. Shown in the upper right corner of chart, just below and right of EF of IS, interlock AB of BTP (normally closed) now opens breaking circuit to PR coil.

With PR coil de-energized all PR interlocks change to their *normal* positions. NP of PR opens dropping out SH coil and contactor. This causes AB of SH interlock to open, dropping out BF coil and contactor. CD of PR interlock opens to drop out P1, P2, P3, P4 contactors. AB of P1 and QR of PR move to their normally closed positions picking up S14 and S23 coils and contactors. EF of PR, CD of S14, and CD of S23 move to normally closed positions to pick up SH coil and contactor, while AB of SH now closes to again pick up BF coil and contactor.

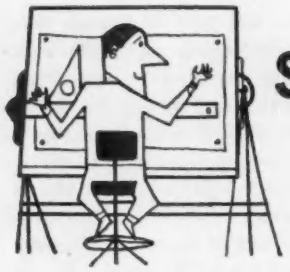
Thus the transition steps have been accomplished to restore traction motor circuits to the original series-parallel connections. The time required to make these transitions changes is practically negligible. Even the change from series-parallel-shunt to parallel, which requires the largest number of separate actions, involving approximately 14 changes energization or de-energization of coils, closing or opening of contactors and of interlocks, takes only a matter of about one second.

Overriding Solenoid (ORS) No mention has been made of ORS coil shown on diagram in the transition circuit, as it does not play a part in the transition described. This overriding solenoid in the governor is energized whenever the battery field contactor (BF) is open and CD interlock of BF is closed (both normal positions.) This situation occurs whenever the throttle is in *idle* position, or during transition from (2) series-parallel to (3) parallel or from (3) to (2), and during wheel slip action.

The energizing of this solenoid causes the load regulator to move into or toward the minimum field position, depending upon the length of time the ORS is energized. When BF contactor closes interlock CD of BF opens de-energizing ORS which permits the load regulator to function normally.



Automatic Transition Panel—AB and CD of FTM and AB of FTP are shown schematically in Chart V. The two 10,000 ohm resistors shown are also found in Chart V at lower left.



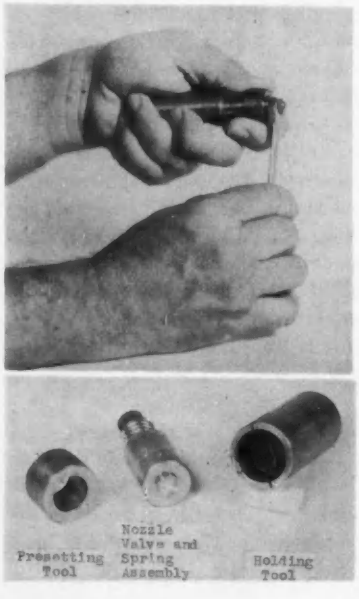
service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

INTERNATIONAL HARVESTER —Nozzle Valve and Spring Assembly Presetting and Holding Tool—All Diesels . . . .

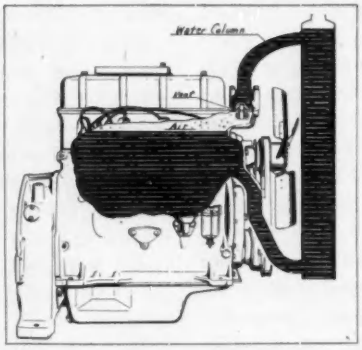
A tool (1 020 320 R91) for presetting and holding nozzle valve and spring assemblies, when adjusting for the correct opening pressure, is now available. It will prevent the valve from turning on its seat, thus eliminating any chance of leakage.

The holding tool slips over the nozzle and spring valve assembly, engaging the cross slots in the valve to prevent it from turning. The presetting tool slips over the spring at the other end of the assembly, serving as a guide in making adjustment. The adjusting nut is then turned on the valve until its bottom face is in line with the surface of the presetting tool. Price of the tool is $1.50 and orders should be sent to the manufacturer: Sterling Products Company, 121 North Jefferson Street, Chicago 6, Illinois.



WAUKESHA — Radiator Filling Procedure—All Power Units . . . .

From time to time, reports are received that difficulty has been experienced in filling the cooling system to capacity on the first attempt. This may occur in nearly any engine model, and as a matter of fact, on any make engine, if the filling rate



is so great as to fill the lower half of the radiator and block faster than air can be vented through the small air vent in the thermostat.

When this happens, a water column may fill the upper thermostat housing and the outlet hose. This will stop or greatly retard the venting action so an air trap exists somewhere in the upper portion of the engine. After the engine has been run and the water circulated, it will be found that more coolant is required.

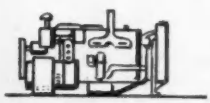
To prevent operating without sufficient coolant, the engine should always be checked for correct water level after coming up to temperature. As a matter of good practice, however, the correct filling procedure consists of filling the radiator slowly enough for the air vent in the thermostat to release the trapped air ahead of the water.

In those cases where rust and deposits are present in the cooling system, the vent hole in the thermostat may be plugged and prevent proper filling. A common symptom of this condition is an overflow of coolant through the filler cap opening or vent shortly after the engine is started.

This results from expansion of the trapped air as the engine warms up. Since the thermostat is closed and the vent plugged, the only escape path is back through the filler.

CATERPILLAR—Single-Bleed Fuel System—D364, D375, D386, and D397 Engines . . . .

A new single-feed fuel system is now used to simplify priming the engine. The single-bleed system differs from the former system only as the name implies; that is, air is bled from the entire fuel system through a single valve and in one operation. Easy-to-follow operating steps are printed on the front of the priming pump housing for the benefit of the operator. The new air-bleed system is adaptable to all earlier engines.



new V-12 WAUKESHA

Diesel VLR SERIES UNITS Gas

TURBOCHARGED DIESEL—1100 HP.
NORMAL DIESEL—800 HP.
NAT. GAS—780 HP.
LPG—870 HP.

Ratings are for Complete Units at 1200 rpm

This powerful turbo-supercharged Waukesha is a twelve-cylinder, 60-degree vee, even firing, four-cycle, solid injection, overhead valve, compression ignition Diesel, of 8½-inch bore and stroke and 5788 cubic inch displacement. The connecting rod arrangement is of the side-by-side type; opposing pistons operating from a single wide-area crankpin.

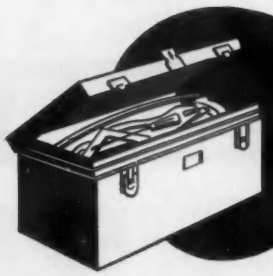
The turbocharged Diesel unit shown above develops approximately 1100 hp at 1200 rpm with radiator, fan, and air cleaners. Without turbocharging, the normal Diesel complete unit maximum rating is 800 hp. The propane-butane model of this V-12 series develops 870 hp. Bare engine ratings of all models are higher. Response to throttle and load requirements is quick and smooth, with a fast surge of reserve power for emergency and overload demands.

Tremendously powerful, remarkably rugged, this V-12 engine is designed for simplicity and reliability. Major parts are interchangeable between right and left cylinder banks. Main and rod bearings are easily accessible. Strength, precision and balance are built into all elements of the power train, from pistons to flywheel. Supporting members are designed for extreme rigidity and perfect alignment of moving parts.

Send for illustrated Bulletins 1663 (turbocharged)—1664 (normal Diesel)—1656 (gas).

270

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN • NEW YORK • TULSA • LOS ANGELES



Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

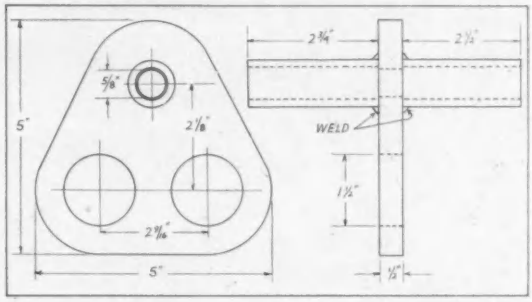
Compressor for Cat D8 Valve Springs

Reo M. Boren, Pocatello, Idaho—Here are some details on an easy-to-make tool that has been a big help to me when replacing Caterpillar D8 valve springs. It is positive and safe to use.

I shaped a ½-in plate to the approximate contour shown in the sketch so as to clear all obstructions. The most important thing is that the holes are accurately located. I bored the two 1½-in holes on 2 9/16-in centers. The 5/8-in hole is 2 1/8-in offset from the middle of a line connecting the centers of the larger holes.

Next, I took two D4400 starting engine piston pins (a 5/8-in ID length of pipe could be used) and welded them to the plate as shown. Projection is 2 3/4-in on one side and 2½-in on the other.

Using the rocker arm shaft stud as a guide, the two 1½-in holes should fit well over the spring retainers. The tool is tightened down and the valve keepers can be replaced without calling for help. So far, no damage to the stud threads has been evident. I always use a thread chaser on all the head studs anyway when the job is finished.



Incidentally, I find strips of wood fastened with 2-in masking tape convenient for holding the valves in place when moving the head.

Such tools can be real time savers as they leave both hands free to work on the keepers. A similar example of a "multiple valve spring compressor" is found in EMD's list of approved tooling for their engines. In this case, all four valve springs are compressed at once. It's a sound idea, Mr. Boren.—Editor

Simple Sound Detector

J. H. Graham, Seattle, Washington—This item for your "Tool Box" section is an easily made sounding device that has been a great help to me in locating troubles even when they first start.

The main part of the "stethescope" is an old telephone or radio earphone. It must have a metal diaphragm. Take out the magnet and coils and drill a 5/32-in hole through the center of the back of the case.

Next, take a piece of 1/8-in brass brazing rod and solder it to the center of the back of the diaphragm. Make the rod any convenient length. Taper the outer end to a fairly blunt point. Put the diaphragm on the case with the rod sticking through the hole and screw on the cap. This makes a mechanical instead of an electrical pickup out of the earphone.

Use the rod as a probe, holding it against the different parts of the machinery you are examining. By putting your ear to the phone, you can pick out a large variety of sounds and identify them correctly after a little practice.

As a start, try it on different bearings, both sleeve and ball types. Each will have its own distinctive sound. In a little while you can tell when clearance is too great and with anti-friction bearings, spot flat balls, worn races, or even if there is too much or too little grease. Injection pumps and injectors have their own sounds that will be quite different when they are malfunctioning. Even arcing brushes on enclosed DC machines can be picked up. Get used to your machinery's sounds and you'll spot trouble before it is serious.

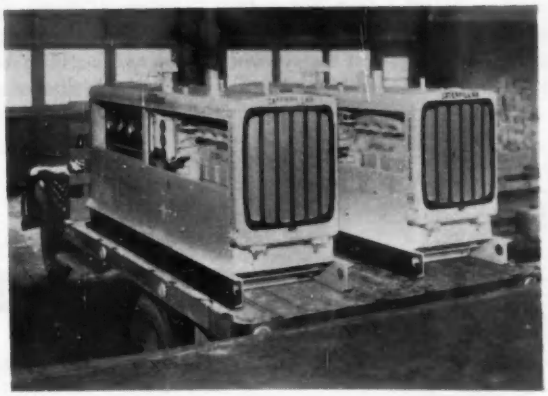
news of our industry

Cat Announces Welders

A new diesel-powered 300-amp welder has been announced by Caterpillar Tractor Co., Peoria, Ill. The unit was introduced at the Pipe Line Contractors Convention in Los Angeles, Calif., early this year. Working in cooperation with the Lincoln Electric Co., Caterpillar is fabricating the welder with twin generators driven by a single engine.

The new welder received one of its first field tests on a pipelaying job near Greensburg, Kans., by R. H. Fulton and Co. of Lubbock, Texas. A better arc and less adjustments of the controls were some of the advantages reported by the welders on that job.

The Twin Arc-Welder, as it is called, consists of a Caterpillar D315 engine and two Lincoln 300-amp welding generators in a single frame.



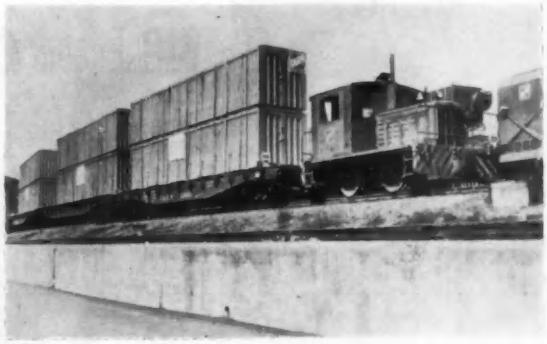
Still Growing Strong

After the equivalent of more than 18 years of normal usage, a 20-ton Baldwin diesel-hydraulic industrial locomotive is still giving top performance in the Neville Island yard of Dravo Corp.

Purchased in 1942, this Baldwin-Lima-Hamilton Corp. locomotive was kept on 24-hr duty during the war years transporting heavy loads of steel and fabricated parts and supplies between shop buildings and shipyard. Loads frequently consisted of from 130 to 170 tons gross train over trackage which in some places has a 3% grade.

Many of its points of pickup and delivery were in areas of heavy sand-blasting operations. Even though running gear and engine were exposed to this abrasive sand and dusty atmosphere, its service availability during the years of 1942 to 1945 was three times the normal expected use of a yard locomotive.

Recent tests made on the Baldwin showed it was fully capable of exerting its full rated tractive effort of 10,000 lb (25% adhesion) without sand, and 12,000 lb (30% adhesion) with sand. It is powered by a 6-cyl, 160-hp Hercules diesel engine operating through a hydraulic torque converter and chain drive.



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news of our industry

Piggy-back Study Underway

At a meeting of the Council of Eastern Rail and Truck Common Carriers, a joint engineering committee was appointed to study the technical aspects of piggy-backing. The committee will investigate the most efficient and economical methods of loading and unloading trailers on freight cars, and the type of railroad car and trailer best adapted to the service.

Crawlers Speed Ship Unloading

Crawler tractors are being used to reduce cost and time required to discharge ore cargoes from ships at Corpus Christi, Tex.

Under the new system, as soon as a ship docks, an International TD-6 crawler with a Drott Skid Shovel is placed in a harness and lowered into the hold of the vessel by a dockside railroad crane. While a clamshell shovel replaces the harness on the crane, the TD-6 builds up a mound of ore in the center of the opened hatch. With this loose pile to work on, the clamshell can grab a heaped load every trip, lift it out of the hold and deposit it in waiting gondola cars with a minimum of time.

The labor force involved in unloading has been halved from the former 18 to nine. The old manual labor system discharged from 25-30 tons per hour compared to the present average of 120 tons per hour.

Honan-Crane Name Changed

Coincident with its introduction of a new line of oil filters and two new cartridge-type filtering elements, Honan-Crane Corp. has had its name changed to Houdaille-Hershey of Indiana, Inc. Honan-Crane has been operated as a subsidiary of the Houdaille-Hershey Corp. for the past 10 years.

Formation of the new corporation marks the first step in the parent company's plan to establish a filtration division in this Lebanon, Ind., subsidiary. The tradename "Honan-Crane" will be retained to identify the company's oil filtration equipment.

McLean Trailership Plan Set

Malcolm McLean, principal stockholder of McLean Securities, has cleared the decks for immediate construction of "trailerships", ocean-going vessels which will transport loaded truck-trailers between Gulf and Atlantic ports. First reported in the March, 1954 issue of DIESEL POWER, the plan emulates the railroad use of "piggy-back" operation.

First step in the project has been the purchase from Waterman Steamship Corp. of two of its subsidiaries, Pan-Atlantic Steamship Corp. and Gulf Florida Terminal Co. The transaction includes transfer of seven C-2 combination passenger-cargo ships. New trailerships to be constructed will be designed to transport 286 35-ft truck-trailers.

The McLean Trucking Co., from which Mr. McLean resigned, is going ahead with its own plans to purchase S. C. Loveland Co., an Atlantic coast water carrier. ICC approval is still forthcoming. McLean Securities does not need ICC approval since it is not a carrier.

RUGGED ACCURATE

DETROIT "Vernatherm" CONTROLS

...for BIG Engine Cooling!

"Vernatherm" means a solid-charged thermostat which will take all the punishment that big engines and rough duty can give it, and give positive, precise coolant control *indefinitely!*

These thermostats were pioneered by Detroit Controls Corporation to meet the requirements of modern pressurized cooling systems. They have provided the answer to a great number of tough problems on Diesel, heavy-duty gasoline and jet engines. "Vernatherm" controls might be the solution to a situation in *your* engines . . . Call on DETROIT sales engineers for test data and actual results in the field . . . or write for Bulletin 213 which gives basic data on "Vernatherm" controls and their function in modern engine design.

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news of our industry

International Engine Congress

Two American papers will be presented at the International Internal Combustion Engine Congress scheduled for May 23-28 at The Hague, The Netherlands. Theme of the gathering will be the development of diesel engines for railway traction and high-powered marine and stationary installations.

Out of a total of 43 submitted papers, 28 have been selected. These will include a paper by William J. Fritton, vice president of Van der Horst Corp. of America, on maintenance techniques used in diesel-electric locomotive repair shops of American railroads, and a paper regarding the relation of cylinder size to design and performance of diesel engines in railway and marine service to be presented by C. Fayette Taylor, professor of automotive engineering at the Massachusetts Institute of Technology.

Robert L. Stanley will represent the Diesel Engine Manufacturers Assn. at the congress. All others interested in attending may write the Netherlands Organization Committee, Nassaulaan 13, The Hague.

Rails Study New-Type Trains

After a 6-mo evaluation by a joint committee of six railroads, it has been concluded that three distinct types of new train designs should be constructed and operated. These are in addition to a modified Talgo-type train being built by ACF Industries for the Rock Island. Four railroads have announced that they will soon place orders for the new designs, with all other cooperating railroads to share information regarding results.

The Pennsylvania has authorized construction of a 7-coach train of tubular design, containing a power car for air conditioning, heating and lighting. It will have depressed centers for 2-level seating arrangement, this low gravity center permitting greater speeds. The train will be interchangeable with conventional equipment and will be put into moderate distance service between major cities such as New York and Washington.

The New York Central will purchase a complete integrated train similar to the design known as Train "X". It is also planning experimentation with moderate distance trips.

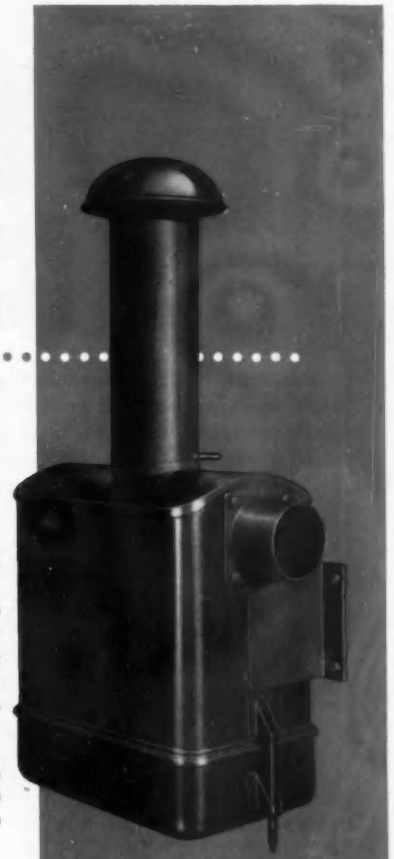
The New Haven has agreed to buy a train which is being designed in cooperation with Grumman Aircraft. Concentration will be on its mainline New York to Boston service.

The Santa Fe has announced it will soon decide upon a new design to be used first in its "El Capitan" which runs between Los Angeles and Chicago.

The other two cooperating roads, Baltimore & Ohio and Chesapeake & Ohio, have postponed announcement of their plans for new trains.

An experimental train with a special high-speed diesel is also being developed by General Motors, it was recently learned. Intention is to have it available for trial use in the later months of 1955.

Rectangular Diesel Air Cleaner Solves Tight Fit Problem



Problem: United Specialties was confronted with the problem of designing a diesel oil bath air cleaner which could be fitted into limited under-the-hood space.

Solution: United engineers departed from the conventional round shape and designed a new rectangular air cleaner which was shaped to fit into the available space, providing more room for accessories. This new cleaner with instantly removable dual filters is available in the following sizes:

5¾ x 9½ for an air capacity of 175 cfm
6½ x 11 for an air capacity of 240 cfm
7½ x 12¼ for an air capacity of 300 cfm
8¾ x 14 for an air capacity of 400 cfm
10 x 16 for an air capacity of 525 cfm
11½ x 19½ for an air capacity of 740 cfm

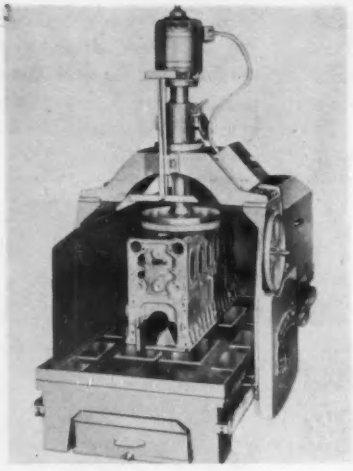
Here is another example of how United Specialties engineers helped solve a tough design problem. We invite your inquiry.

AIR CLEANERS • METAL STAMPINGS
ROLLED SHAPES • IGNITION SWITCHES
TURN SIGNAL SWITCHES • DOVETAILS

United Specialties Company

United Air Cleaner Division
Chicago 28, Illinois
Mitchell Division
Philadelphia 34, Pa.
Birmingham 11, Alabama

new products



New Wet Surface Grinder

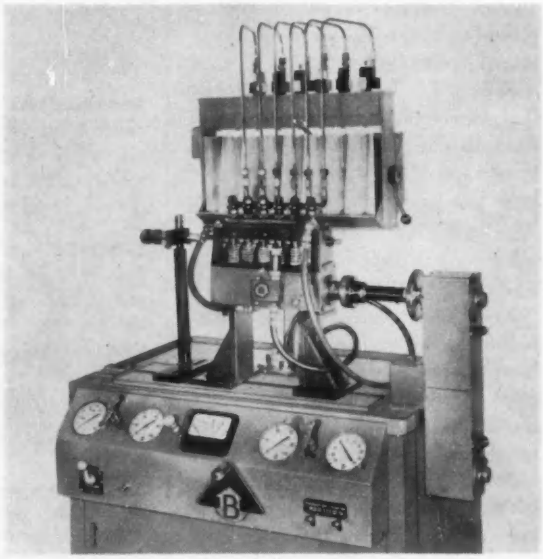
Peterson Welding Labs, Inc., 1423 Virginia Ave., Kansas City 6, Mo., has introduced a new universal wet surface grinder designed for fast, efficient, accurate grinding and resurfacing of heads, manifolds, and blocks for both inline and V-8 type engines. The all-inclusive capacity of this new wet grinder makes it practical for all sizes and types of internal combustion engines, up through and including the 13000 Caterpillar engine, according to the manufacturer.

To fleet owners, dealers who farm out this work, and also to individual owners who patronize shops using the new machine, the wet grinder means less downtime and better service. Additionally, the accuracy possible with the new grinder is said to be an assurance of many more miles between grinding jobs. Designed for easy loading, quick setup and alignment, and full vision grinding—and featuring the use of a 5-in faced, flat-dressed 16-in grinding wheel and new cooling system, the new grinder reportedly makes head and block resurfacing as much as three times faster.

Calibrating Stand

Bacharach Industrial Instrument Co., 7301 Penn Ave., Pittsburgh, Pa., now has available a "universal" diesel fuel pump calibrating stand. It is said to be the first such stand priced low enough to make it a sound investment for every shop handling fuel injection equipment even though the volume of such work is limited or the test stand is to be used primarily for selecting the pumps which should be returned to the manufacturer's service branch for rebuilding.

According to the manufacturer, drastic price reduction has been achieved by a basically new design conception. The pump drive shaft is located below the bed plate extending from side to side of the stand. Transmission of power from the drive shaft to the pump coupling is accomplished by a power arm which can be changed from left to right side of the stand.



Portable Refueler

The advantages of keeping equipment refueled on the job are too apparent to mention here, but the advantage of clean dirt-free fuel, serviced on the job, is of vital importance where labor charges and work performance are considered. Briggs Filtration Co. has designed a portable refueler which can be used almost anywhere. It is comparatively light in weight, wheels freely over gravel, dust and rugged terrain. One man can operate its 10-gpm self-priming hand pump and thus return the truck or tractor to productive employment quicker than sending the truck to a too distant refueling point.

The portable refueler can be used on a fuel truck or on the ground. The fuel drum arm is inserted in the oil drum and takes fuel well above the water and sludge line of the drum—in this manner eliminating moisture from the fuel.

new products

New Diesel Lube Oil

Cities Service Petroleum Inc., 60 Wall Tower, New York, N. Y., has released a new type of railroad diesel lubricating oil to its marketing groups. It is said to have been tested in over 30 million miles of railroad operation and to have won the approval of major railroad diesel engine builders.

Made from high-viscosity-index stocks, the oil contains an additive for satisfactory performance under heavy-duty service and high-sulphur and low-octane number fuels. Company engineers, preparing for the future, claim it is perfected for lubrication of diesels geared for a higher output than those in present-day operation.

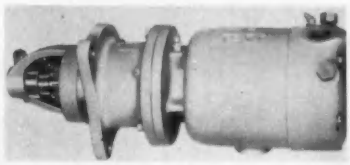
Socket Wrench Adapter

Designed with right-angle drive to work on hard-to-get-at places and around heat and blind spots, is a new type of adapter for use with standard ratchet sets and accessories. According to the manufacturer, Reechet Tool Corp., Cleveland 15, Ohio, the tool will withstand torques in excess of a comparable ratchet of equal drive up to 1500 in lb, with an approximate gear ratio of 2 to 1. It is adaptable for controlled production line use with air or electricity.

Propane-Burning Hand Torch

For small or large heating requirements in or beyond the capacity of conventional blow torches or soldering irons, Fire Gun Sales Corp., 2500 W. 7 Ave., Denver 4, Col., is distributing a portable hand-operated heat tool that burns propane within a range of 4000 to 117,000 Btu per hour.

The trigger-controlled gun burns a 3650°F clean flame, it is claimed, and operates at about one-tenth the cost of an acetylene torch for the same amount of heat. A basic kit includes a heat concentrator tip, a high-heat or blow torch tip, soldering iron tip, hose, regulator, pressure gauge, and steel carrying box.



Air Starter for Small Diesels

A third size air starting motor has been announced by Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y., to complement its range of air starters for heavy-duty requirements. Called the Size 5BM, this latest is designed for starting service on diesels having 300- to 700-cu in displacement.

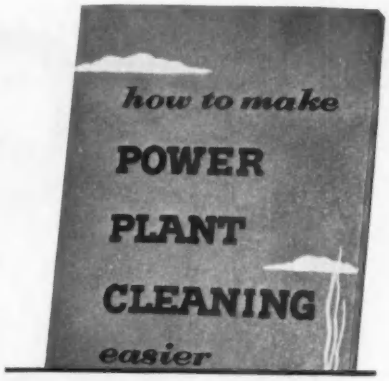
Said to be smaller and more compact than equivalent electric starters, the unit incorporates the company's Multi-Vane air motor as the power source. Eliminating gears, it is directly connected by means of a splined shaft to the Bendix drive unit. Bearings are sealed to retain grease and keep dirt out.

Bulk Loading Valve

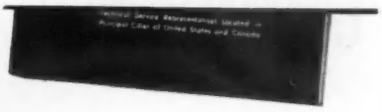
Combining electrical control and manual operation, the new Bulletin 8023 solenoid valve produced by Automatic Switch Co., 391 Lakeside Ave., Orange, N. J., has been designed to control fuel flow in remote metering systems. It is installed in the meter line of a bulk loading terminal's remote metering system.

In operation, the dispatcher must first insert a ticket in the remote control register to clear the machine and energize the loading valve. The truck operator can then start filling by manual control, adjusting the rate of flow as required. The dispatcher de-energizes the solenoid valve by remote control after the truck operator has finished loading so that no more oil can be drawn until a new ticket has been inserted in the register. Flow can be stopped at any time by the dispatcher by de-energizing the solenoid valve.

By employing the valve in a remote system, complete control of bulk plant operations is placed inside the office. The valves are supplied standard with straight-through pipe connections and operate in any position.



Your Guide To Diesel MAINTENANCE CLEANING



Here—in this new Power Plant Cleaning Guide—you will find one money-saving suggestion after another to help speed up your diesel overhauling and reconditioning work. Here, for example, are described the most modern, most effective procedures for:

- **Soaking hard carbon deposits off aluminum pistons**
- **Removing rust and scale from diesel cooling system**
- **Cleaning filters**
- **Desludging lube oil coolers**
- **Degreasing parts before repair**
- **Steam-detergent cleaning**
- **Stripping paint**

And saving time and money on many other important maintenance operations.

A FREE copy of this informative booklet will be mailed promptly on request. No obligation. Write Oakite Products, Inc., 22C Rector Street, New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
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MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

Put a HOFFMAN OIL CONDITIONER on the job taking care of your Diesels—and watch your lube oil costs go down. Contamination is removed faster and viscosity is protected by baking off all "thinning" agents. Maintenance costs due to engine wear are cut in half . . . . the safety of your plant and your workers is increased.

What's more the compact, single unit, HOFFMAN OIL CONDITIONER often pays for itself in a short time, *in lube oil savings alone.*

Let a HOFFMAN Filtration Engineer study your oil conditioning problem and help you make your selection from HOFFMAN's stationary or mobile units, with capacities ranging from 25 to 600 GPH.

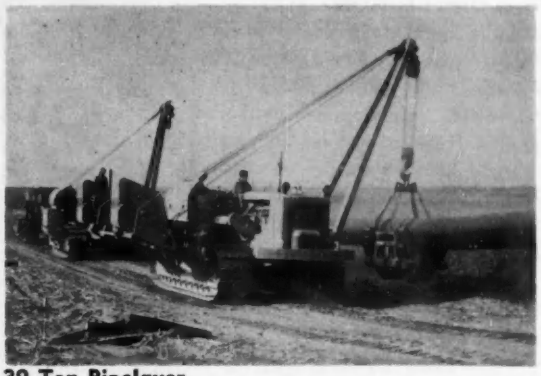
For more detailed information and reports from users, write for Bulletin #974, and Case Study #6.

Installation of a Hoffman 300 GPH unit at Wolverine Electric Co-op Inc. Hersey, Mich. resulted in tremendous lube oil savings.

Pump driving diesels at Trans-Arabia Pipe Line Co. require *less* maintenance with Hoffman Oil Conditioners on the job.

Industrial Filtration Division
U. S. HOFFMAN MACHINERY CORPORATION
DEPT. D. P., 105 FOURTH AVENUE, NEW YORK 3, NEW YORK

new products



39-Ton Pipelayer

Caterpillar Tractor Co., Peoria 8, Ill., is marketing a new pipelayer, the No. 583, having a lifting capacity of 130,000 lb and a 21-in ground clearance. Powered by a 4-cycle, 6-cyl diesel engine delivering 190 hp at 1200 rpm, it burns No. 2 furnace oil with a minimum cetane rating of 35. Starting is by independent 2-cyl gasoline engine with a 6-v electric starting system.

The big machine employs rubber-tired cradles to lower pipe. On try-out test, it supported an estimated 700 to 800 ft of pipe continually, and lowered in at the rate of over 2 mi per day. Excellent latitudinal stability is said to be given by the engine center, 86-in gauge, 28-in track. Boom is centered and counterweights are split fore and aft of the winch mechanism for longitudinal balance.

The pipelayer drive is independent of the tractor master clutch and the torque converter. Arrangement of the power take-off leaves rear of the tractor free for installation of rear-mounted equipment.

New Railroad Air Brake Valve

Westinghouse Air Brake Co., Wilmerding, Pa., announces that it has developed an improved railroad freight car air brake control valve to supersede its AB valve. The new AC valve has been presented to the AAR for consideration.

According to the company, the new type, which will operate with existing equipment, gives improved brake functioning, is lighter in weight, more simply designed, more economical to operate, and less costly to maintain. Major parts are of aluminum, about 40% lighter than those of the AB. A synthetic rubber diaphragm is used for air flow control instead of the conventional piston and ring arrangement, and rubber seal rings substitute for metal slide valves. These developments, it is claimed, will give positive brake operation and should permit longer between-cleaning periods.

A faster serial release of brakes is another feature. As an example, brakes on cars at the rear of a freight train 1½-mi long will begin to release 9 sec after those at the head of the train.

new products

Dynamotor for Railroad Radio System

To permit use of 6- or 12-v mobile communications equipment on 32-, 64-, or 110-v diesel locomotives, Carter Motor Co., 2644 N. Maplewood Ave., Chicago 47, Ill., has developed a custom dynamotor. On installation of the dynamotors, switch engines can be tied in with the rest of mobile railway communication systems.

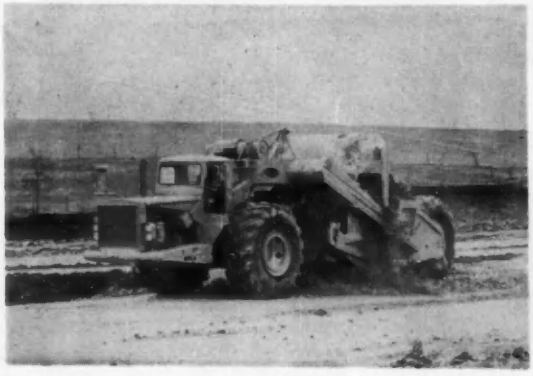
The units are 12⅝-in long, 6 11/16-in wide, 7¼-in high, and weigh 47 lb. They are rated 70 v input, 12.8 v at 5 amp receive and 18 amp transmit. A steady output of 12.8 v, within 10%, is claimed maintained even with input varying from 5 to 18 amp. Regulation at fixed input is 0.7 v transmit to receive. This is said to result from operating a machine capable of 500 watt continuous duty at less than 100 watt continuous and less than 250 watt intermittent. This underloading permits slow speed and low temperature rise, and coupled with oversize brushes, extra long life is said attained. Standard models come in four input ranges from 33 to 74 v, with outputs of 6.3 and 12.8 v.

Single-Engine Scraper

Powered by a 293-hp diesel (choice of Cummins or GM), the pictured B Tournapull is the newest offering of LeTourneau-Westinghouse Co., Peoria, Ill. It provides 10 gear ratios ranging from 2.4 to 28.4 mph.

Accessibility has been emphasized in the design of the machine. All major assemblies may be removed without time-consuming handling of other components. For example, the transmission can be dropped in an hour without pulling the engine.

Power steering and a fuel tank large enough for a 10-hr supply are other features. Operation controls include a lever for raising and lowering bowl, shift lever, transfer case lever, and hand throttle. Accelerator, clutch, and brake are operated by floor pedals. Starting is by dashboard pushbutton. Tires and wheels are interchangeable between prime mover and scraper. Struck capacity of the scraper is 18 yd; heaped capacity is 23 yd without sideboards. Overall length of the machine is 40 ft, 6 in. A 35-ton rear dump is interchangeable with the scraper for use with the Tournapull.



it pays to know the EXACT RPM of your DIESEL ENGINE!

Get maximum efficiency longer engine life

for BUSES • TRACTORS TRUCKS • BOATS

EASY TO INSTALL NO DRIVE CABLES

6, 12, or 24 VOLT ILLUMINATION

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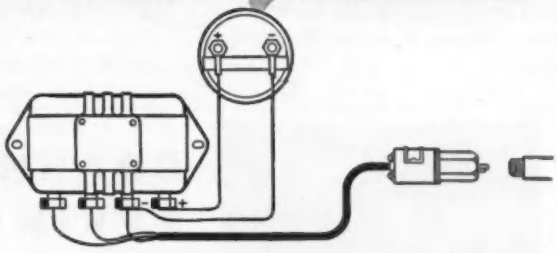
HIGHEST ACCURACY LONGEST SERVICE LIFE

RUGGED, DEPENDABLE EASY TO READ

with new Sun MECHANICAL DRIVE ELECTRIC TACHOMETER!



Now, New Sun Mechanical Drive Electric Tachometer for diesel engines gives consistent, more accurate RPM readings for greater diesel efficiency and economy!

Operation is simple and foolproof. The new Sun Power Units are available for standard S.A.E. drive ratios—and S.A.E. mechanical drive outlets. Troublesome, long drive shafts are eliminated. The Sun Transmitter Unit attaches to any S.A.E. mechanical drive outlet where electrical impulses are picked up and transmitted to the Power Unit and then relayed to the "Tach" head in terms of RPM.

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(GASOLINE ENGINE)
☐ SUN ELECTRIC TACHOMETER
☐ SUN DRIVING GAGE

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ADDRESS_____

CITY_____STATE_____

new literature

Series 110 Diesels

Detroit Diesel Engine Div., General Motors Corp., Detroit 28, Mich., has begun distribution of a 32-page bulletin on its Series 6-110 diesels, detailing both industrial and marine models from 200 to 575 hp.

Entitled "Power for Progress", the brochure covers features of design, specifications, and power curves of single-, multiple-engine, and torque converter units. Included are photos of the engines at work in various types of equipment.

Vibration Analyzers

Offered by International Research and Development Corp., 16 E. Hosack St., Columbus 7, Ohio, is a 16-page brochure discussing the advantages of its vibration analysis equipment in eliminating unwanted vibration wherever it occurs in rotating parts.

Water-Cooled Air Compressors

Quincy Compressor Co., Quincy, Ill., is offering an 8-page folder describing its complete line of water-cooled air compressors. Each type is illustrated and detailed with features, dimensions, and specifications. Standard features of all models are shown in a special cutaway spread. Application photos depict various industrial uses.

Portable Railroad Jacks

An illustrated bulletin has been published by Whiting Corp., Harvey, Ill., giving complete details on its portable electric jacks for railroad repair shops and other heavy-duty industrial lifting. The jacks, ranging in capacity from 25 to 80 tons, are shown at work equipped either with flat base and moved by overhead crane or mounted on wheels for parallel movement to the track.

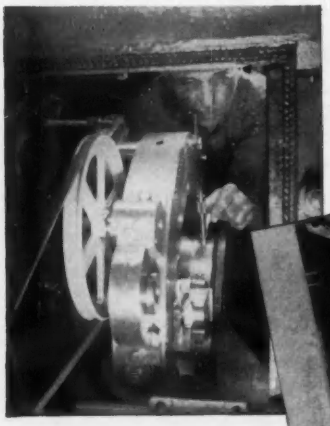
Worthington DR Diesels

The versatile uses of its DR diesels, which operate as oil, oil and gas, dual-fuel, and spark-ignition gas engines, are explained in folder recently issued by Worthington Corp., Harrison, N. J.

The literature contains a special chart showing the various ratings for the 5-, 6-, 7-, and 8-cyl engines which are available in 550 to 2200 hp. Sections of the engines are illustrated to point out major mechanical features, and specific parts are described. Four charts also illustrate fuel cost curves for each of the fuel systems. Industrial applications are included.

O-Ring Catalog

For both dynamic and static installations, The Garlock Packing Co., Palmyra, N. Y., has issued a catalog describing its complete line of O-rings. Design information, recommended pressures, and available material for both applications are contained, including a complete listing of standard sizes.



CRANK PINS REFINISHED IN PLACE

For engines of practically any size our Portable Machines are available for quick and economical restoration of damaged crank pins. Let us help you minimize down-time.

Requests for the purchase of these machines have become so numerous we have decided to manufacture them for sale and invite your inquiries.

Above illustrations show views of our Portable Crank Pin Machines at work in various size marine engines. At right a marine engineer checks the accuracy of a refinished crank journal.

Additional information furnished without obligation

WASHINGTON IRON WORKS, INC.
Established 1876
SHERMAN, TEXAS

HERE'S WHY INSTALLATIONS COST LESS WITH Bendix STARTER DRIVES

Yes, it costs less to install a Bendix* Starter Drive, but that's only part of the story. The outstanding efficiency of the Bendix Drive has been performance proven in over 100,000,000 installations. No other starter drive approaches this record. Whatever your type of diesel, or whatever its purpose, for more dependable all-around performance it pays to specify Bendix Starter Drive.

*REG. U.S. PAT. OFF.

CHECK and COMPARE THESE FEATURES

- Starting motor can be mounted more easily and in more positions.
- Requires no actuating linkage—solenoid can be placed in any convenient position.
- Simple in design—has fewer parts—needs fewer adjustments.

ECLIPSE MACHINE DIVISION of Bendix AVIATION CORPORATION
ELMIRA, NEW YORK
Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N.Y.

new literature

Tank Vent Flame Arresters

Contained in a new catalog sheet issued by Air-Maze Corp., 25000 Miles Rd., Cleveland 28, Ohio, are details of its line of tank vent flame arresters designed to be mounted on the ends of vent pipes of storage tanks containing volatile liquids.

Passage of sparks or flame from the outside of the tank to the inside is prevented by a series of wire baffles within the arresters. Foreign matter is also arrested. Eight models are illustrated together with operating and design data and complete specifications.

Torque Converters

Designed to meet a wide range of engine applications are the Torcon torque converters described in an 8-page bulletin issued by Clark Equipment Co., Falahee Rd., Jackson, Mich. The brochure depicts models, shows attachments for specific adaptations, and gives construction features.

Better Lubricating Oils

The research story in the development of better lubricating oils is related in a new booklet published by Caterpillar Tractor Co., Peoria 8, Ill. "Let Your Diesel Live", a 16-page booklet, describes the problems met by research engineers in finding a lubricating oil that possesses suitable lubricating characteristics. Additives are discussed, especially in relation to high sulphur fuels. Series 2 oils are described as the answer, giving longer engine life and increasing oil change periods.

Automation Dictionary

The Industrial Div. of Minneapolis-Honeywell Regulator Co., Philadelphia 44, Pa., has packaged the most broadly used technical terms by instrumentation engineers into a small booklet containing laymen definitions. Primarily designed "for those whose knowledge of automatic control is largely limited to the setting of the thermostat on the living room wall," the booklet covers some 87 words and phrases.

Facts on Filtration

Engine Life Products Corp., El Monte, Cal., announces that it is preparing a series of oil filter discussions designed to be of help to both the engine manufacturer and operator.

First in the series, "Fundamentals of Filtration" has just been released in the form of a 12-page booklet. It discusses the relation of filtering equipment to the engine lubrication system and covers contaminants and the damage they do, filter materials, limitations of chemical filters, filter construction, conditions affecting size of filter and type of installation, and the filter in relation to engine fuel and detergent oil.

Electrode Comparative Chart

An up-to-date bronze electrode comparative chart (54D-203) has been compiled by Ampco Metal, Inc., 1745 S. 38 St., Milwaukee 46, Wis. It lists all known brands of aluminum bronze, phosphor bronze, nickel-aluminum bronze, and manganese bronze electrodes on the market.

organizational news

F-M Railroad Sales Posts

C. H. Morse, Jr. has been appointed to western regional manager, Railroad Div., of Fairbanks, Morse & Co., with responsibility for the Middle and Far West. He has successively been manager of locomotive sales in Chicago, assistant manager of the locomotive service department, and manager of the last named department for the past four years.

William G. Herzig is the new manager of the railroad product sales department, succeeding J. F. Marquitz who is retiring. Mr. Herzig has been with F-M for nine years, his last assignment as manager of railroad sales of the Chicago branch.

C. H. Morse, Jr.

W. G. Herzig

Cooper-Bessemer Promotions

Two sales promotions have been announced by The Cooper-Bessemer Corp. Robert F. Lay is now general sales manager and Grant C. Woodard the new assistant general sales manager.

Mr. Lay first became associated with C-B as a co-op student in 1924. He later joined Baldwin Locomotive Co., became assistant sales manager, and moved on to The Elliott Co. Returning to C-B in 1946 as head of its stationary application engineering section, he held that position until a year ago when he was promoted to chief engineer, Products Div. Some months later, he was named assistant general sales manager.

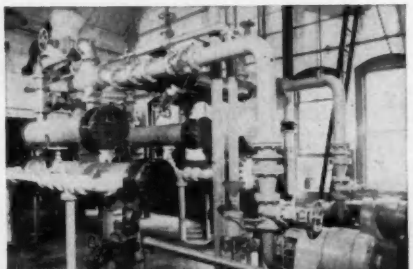
Mr. Woodard received his basic training at the company's factory in Mt. Vernon, Ohio. He then served as application engineer and later as sales engineer on engine and compressor installation for pipelines and refineries.

R. F. Lay

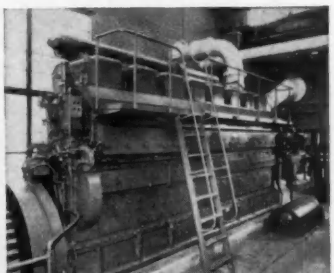
G. C. Woodard

SIMS provides dual service for WORTHINGTON dual fuel diesels . . . at Clyde, Ohio

4 Sims Heat Exchangers keep jacket water at uniform temperature and engine lube oil cooled to the specified temperature. The City of Clyde enjoys a considerable fuel and operating savings per Kw.-hr. generated because of this well engineered diesel installation. Sims meets Worthington's high standards at the City of Clyde and it's know-how is available to all diesel builders. 16 page Bulletin HR-2, "*Sims Heat Recovery from Internal Combustion Engine*" is available.



2 Sims Jacket-Water Heat Exchangers and 2 Sims Lube Oil Coolers serve 2 Worthington Dual-Fuel Diesels.

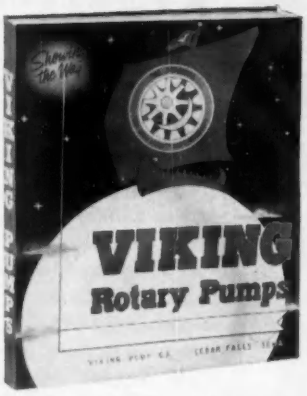


One of two Worthington SEHGO-8 2010 hp. Dual-Fuel Diesels operating at City of Clyde, Ohio.

THE SIMS COMPANY • BOX 1096D • ERIE, PENNSYLVANIA

SIMS HEAT RECOVERY EQUIPMENT

HEAT EXCHANGERS • EXHAUST GAS BOILERS • STORAGE WATER HEATERS • DE-AERATING AND CLOSED FEED WATER HEATERS • STEAM SEPERATORS • COMMERCIAL TYPE INSTANTANEOUS WATER HEATERS • OIL HEATERS • QUENCHING OIL COOLERS.



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Just check at right the catalogs you want. Attach to your letterhead and mail.

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- ☐ E- d Jacketed Pumps
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- ☐ G- d Oil Industry Pumps
- ☐ H- d LP-Gas Pumps
- ☐ I- d Hydraulic Pumps
- ☐ J d Special Application Pumps

VIKING PUMP CO.

Cedar Falls, Iowa

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KIENE® DIESEL PRESSURE INDICATOR

gives compression and firing pressures faster

SIMPLE RELIABLE COMPACT

Send for Bulletin K-100

The Model K-100 Kiene Pressure Indicator accurately measures compression and firing pressures — assures the proper maintenance of diesel engines — helps prevent costly down time. Only one moving part — no friction or inertia effects — no complicated adjustments.

KIENE DIESEL ACCESSORIES, INC.

10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

organizational news

Zallea Sales Representative

Ben McKalip Co., Tulsa, Okla., is the latest sales appointee of Zallea Bros. The company will serve the territory of Oklahoma, Kansas, Arkansas, Kansas City (Mo.), and the Texas Pan Handle.

Schwitzer-Cummins Names Two

The appointments of Kurt A. Beier to the position of vice president in charge of engineering and research and Eugene S. Witchger to general sales manager have been announced by Schwitzer-Cummins Co.

E. S. Witchger

K. A. Beier

Cooper-Bessemer Manager Dies

J. H. Shields, assistant marine sales manager of The Cooper-Bessemer Corp., died suddenly at the age of 54. He was a registered civil engineer and had been closely associated with the marine and stationary power industry on power installations involving diesel, gas-diesel, and gas engines.

Worthington Sales Promotions

Two promotions in the sales staff of Worthington Corp. have been announced. William A. Meiter is the new general sales manager to succeed Thomas J. Kehane whose election as vice president of sales was recently announced. Clarence C. Wentworth has been progressed to the post of central sales manager vacated by Mr. Meiter.

Mr. Meiter has been with the firm since 1927, following his graduation from Ohio State. He served as sales engineer in Cleveland and in 1938 became Buffalo sales manager. He was named central sales manager in 1950.

Mr. Wentworth started with Worthington in 1922 as a service engineer in its Los Angeles office. He became general line salesman in St. Louis in 1929, regional manager in St. Louis and Chicago in 1936, and general line salesman in Chicago in 1948. In 1950 he was made district manager of the Detroit office.

C. W. Wentworth

W. A. Meiter

Snap-on*

HEAVY DUTY LOXOCKETS

SET 432-HD-B

POWER FOR THE TOUGH JOBS! This is the wrench set to have at hand for the jobs that require size and power and sweeping leverage. These tools give *speed* as well—the big handles, adaptors and sockets are sleekly proportioned, versatile and fast working. The more powerful the wrench, the more you want *safety*—and Snap-on provides it—with positive button locking of units to give the security of a one-piece tool. The Loxocket release pin gives fast interchangeability of units. Available through your nearby Snap-on factory branch. For Snap-on industrial catalog, and 104-page general catalog of 4000 hand and bench tools, write

SNAP-ON TOOLS CORPORATION
8064-C 28th Avenue
KENOSHA, WISCONSIN
*Snap-on is the Trademark of Snap-on Tools Corporation.

new literature

How to Clean Mobile Tanks

Replacing a tentative manual issued five years ago, is a new safety book on how to clean tank vehicles used for flammable liquid transportation, known as API Accident-Prevention Manual No. 13A. The American Petroleum Institute, 50 W. 50 St., New York 20, N. Y. is making copies available for $1 each with discounts on quantity orders.

The manual provides information on the cleaning of mobile tanks prior to repair, along with measures which should be taken to protect personnel against harmful vapor concentration and to avoid fire. Subjects covered include repair operations, preparation of tank compartments for gas-freeing, gas-freeing methods, and precautionary measures for hot work.

Rotary Pump Data

Three new catalogs covering its rotary pumps for all industries have been completed by Viking Pump Co., Cedar Falls, Iowa.

Catalog B takes in general purpose pumps and Catalog C, heavy-duty pumps. Both contain complete information on the pumps, how they operate, description and illustration of each model, specifications, performance graphs, recommended speeds and capacities for handling various liquids, and typical installations. Catalog K is devoted to engineering data, giving rotary pump fundamentals, 10 steps to correct pump selection, and 14 pages of engineering charts.

Lift Truck Operation

"How to Operate a Lift Truck", for use as part of an operator training program, is available again from the Hyster Co., 2902 N.E. Clackamas St., Portland 8, Ore.

The 24-page booklet uses the cartoon technique for easy reading and is slanted toward both the beginner and experienced operator. Preventive maintenance, safety, and basic material handling are included, along with drawings for setting up an obstacle course.

new literature

Hydraulic Control Valves

Dimensional data and features of its hydraulic directional control valves for mobile equipment applications, covering 1- through 4-spool models of from 8- to 35-gpm capacity, are provided in a 10-page catalog file available from The Parker Appliance Co., Industrial Hydraulics Div., 17325 Euclid Ave., Cleveland

Carbide Cutting Tools

To facilitate carbide tool selection, the Carbide Dept. of General Electric Co., Detroit 32, Mich., has prepared special tables which suggest first and second selections of carbide grades for various materials to be machined. The tables include feeds, speeds, and depths of cuts for steels, cast iron, non-ferrous, and non-metallic materials, in addition to work involving heat-resistant alloys and stainless steels.

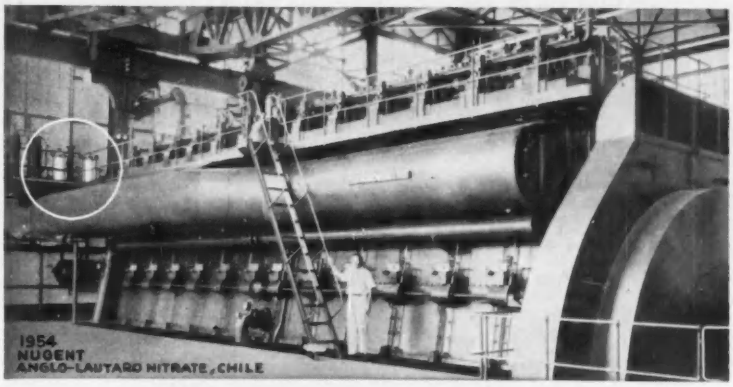
One of the tables suggests rake and relief angles to use on jobs where the tool shank is set perpendicular to the work at the point where the nose of the tool contacts the work. Tools of other types or held in other positions with relation to the work, it is advised, should have tool angles ground to correspond to this standard setup.

Aluminum Extrusion Standards

The second edition of "Drafting Standards—Aluminum Extruded and Tubular Products" has been issued by the Extruded Products Div., The Aluminum Assn., 420 Lexington Ave., New York 17, N. Y. To keep the manual abreast of advances in production and application methods that have developed since the first edition was issued in 1949, many changes have been made.

Explanatory material and diagrams have been added in several sections, particularly those on tolerances and dimensioning. Changes in tolerances have been made where experience has indicated. The first part of the section on dimensioning has also been rearranged and enlarged.

MOST POWERFUL DIESELS



. . . rely on NUGENT FUEL OIL FILTERS!

● The giant diesel shown above is one of two, 9,600 hp. Nordberg engines installed for the Anglo-Lautaro Nitrate Corporation at their plant in Coya Sur, Chile. The diesels are the most powerful single units ever built in the Western Hemisphere.

Included as original equipment on each of these engines is a Nugent #4L4 twin transfer filter (shown in circle above) for preliminary fuel oil filtering and a Nugent #4L Duplex fuel oil filter (not visible) to provide the final filtering. The Coya Sur installation is another example of Nugent filters being installed as original equipment by a leading diesel manufacturer.

Size for size, Nugent filters of the above type offer greater filtering area than any other filter on the market. In addition, the lubricating oil filters make possible a choice of full flow or by-pass with the same unit. Simple piping makes installation no problem.

No matter what the size of your own diesel power supply—no matter where it is installed, there is a Nugent fuel or lube oil filter to meet your needs. Write for complete information.

◀ Close-up of a Nugent #4L4 filter of the type used for fuel oil transfer on the giant diesels at Coya Sur. Recharges are inexpensive and simple to replace.

▶ Nugent duplex filter of the type used for final fuel oil filtering on the diesels at Coya Sur. By actual test, removes 99.8% of all foreign solids from fuel oil.

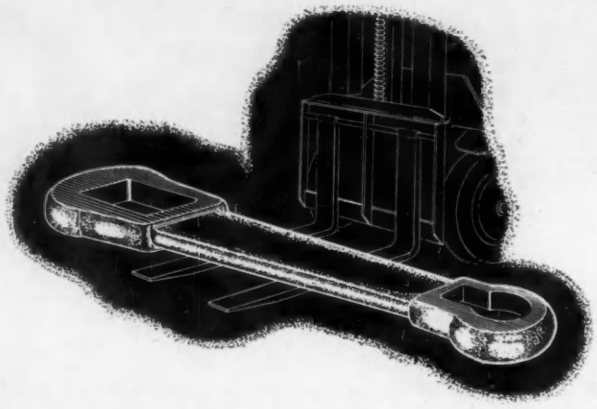
Wm. W. Nugent & Co., Inc.
417 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Established 1897

Representatives in Boston • Cincinnati • Detroit • Houston • La Junta, Colo. • Los Angeles • Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco • Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

Worn? Mismachined?



VANDERLOY* is the answer.

Connecting rods, power cylinders, shafts, rods—i.d. or o.d. surfaces—all can be restored to design dimensions by the application of VANDERLOY.

VANDERLOY* **an electrolytic iron that bonds atomically with most ferrous metals, aluminum, copper, nickel and their alloys.**

Write for additional information on this NEW reclamation service.
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TERRELL, TEXAS
OLEAN, NEW YORK
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HILVERSUM, HOLLAND

*Patents applied for

**SparTan Engineering West Coast Licensee

new literature

Diesel Engine Progress

Proceedings of the 26th Conference of the Oil and Gas Power Div., ASME, have just been made available in bound form, at $3 per copy. Papers and panel discussions center around turbocharging of 2-cycle engines, speed-governing specifications, trends in compressor design, cooling towers, and gas turbines.

Entitled "Diesel and Gas-Engine Advances, 1954", the book also contains panel discussions by pipeline operators, including auxiliary drives, and a report on the international meeting at Mexico City. Annotated with bibliographies, tables, charts, and photographs, the book is obtainable from the society at 29 W. 39 St., New York 18, N. Y.

Tubing Guide

Into eight pages, Superior Tube Co., Norristown, Pa., has condensed information needed for selection and application of 46 standard ferrous and nonferrous tubing produced by the company. The catalog groups the 46 analyses into five classifications: stainless steel, nickel and nickel alloys, carbon and alloy steels, beryllium copper, and titanium. A short summary of the principal properties of each is given along with its normal production limits.

The manufacture of seamless tubing (drawn from hollow tubes) and Weldrawn tubing (welded from strip and drawn) is described, and length limits, straightness tolerances, standard temper designations, and commercial tolerances applicable to various size ranges are listed. A self-mailer questionnaire which can be used to obtain additional data is contained.

Proper Space Utilization

"How to Double Your Warehouse Capacity" is the title of a 16-page brochure made available by The Frick-Gallagher Mfg. Co., Wellston, Ohio. Through the use of special storage equipment, savings of space and time are said to be possible. The advantages of utilizing ceiling height as well as floor space are pointed out.

new products

Masonry Nail Driver

For driving masonry nails into concrete, cinder blocks, concrete blocks, light and medium gauge metals, Safety Nail Driver Corp., Clifton, N. J., has developed the Safe-T-Matic nail driver.

The tool features a built-in permanent magnet which holds the nail in correct position, and a sliding safety shield, said to cut working time and eliminate danger of flying nails. Nails driven by the tool are said to have strong holding power. Use of star drills, plugs, and screws are not required. The driver takes masonry nails from ½- to 1 1/8-in long.

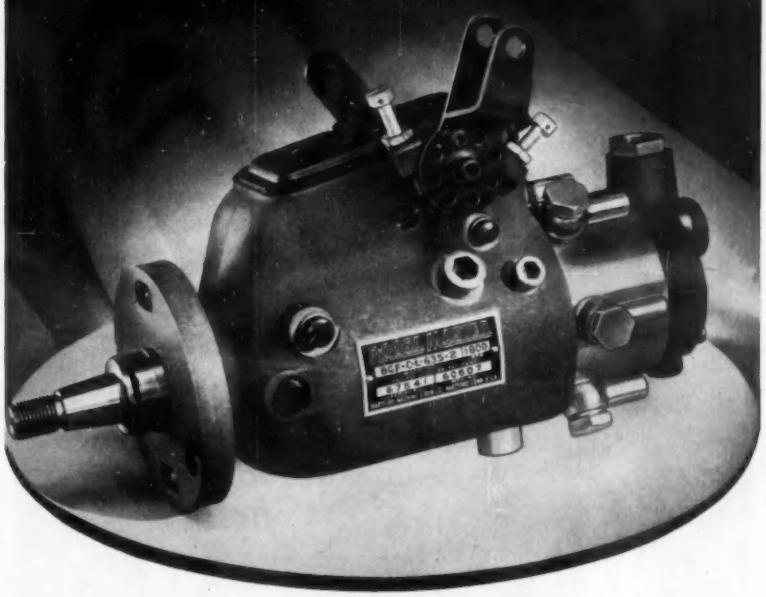
Two-Yard Excavating Machine

An all-purpose excavating machine, the 83-M, with special features designed to make it a 60-ton special lifting crane, has been announced by Marion Power Shovel Co., Marion, Ohio. As a 2-yard shovel it is designed for use in construction, quarrying, and mining, but it is said to be easily converted in the field to a dragline, clamshell, pull shovel, or crane. A third drum is available on the crane for handling piles, snaking-in or snubbing loads, or it can be used as a high-speed boom hoist.

A choice of diesel, gasoline, or electric power is offered. Torque converter is standard equipment. Self-cooling swing clutches are incorporated to eliminate heat damage to the rubber tube of the clutch. Twelve-lb hand pressure by operator on compensating-type air control valves releases full machine power. All units are arranged for easy accessibility in maintenance and adjustment.

THE HARTFORD MACHINE SCREW COMPANY

Proudly Presents



THE NEW

ROOSA MASTER MODEL "B" PUMP

Another Great Advance

IN SIMPLIFIED DIESEL FUEL INJECTION

Another "first" for Roosa Master, the new Model B Diesel Fuel Injection Pump is . . . lighter . . . smaller . . . and more compact . . . yet retains the pace-setting simplified method of fuel injection pioneered by Roosa Master Model A. The new Roosa Master Model B offers both the diesel engine manufacturer and user outstanding performance, exceptional dependability and lower maintenance costs through easier servicing. Write today for complete information.

HMS ROOSA MASTER

DIESEL FUEL INJECTION AT ITS VERY BEST

THE HARTFORD MACHINE SCREW COMPANY • HARTFORD 2, CONN.

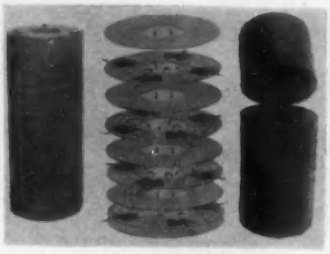
new products

Oil Filter Cartridge

Production of a new filter cartridge claimed to have wide filtering area, low pressure drop, and high dirt storage capacity, has been announced by The Hilliard Corp., Elmira, N. Y. It will be available in two types, F-718 and FW-718, which are alike in structure but permit different methods of installation.

The filter paper used in the standard cartridges is said to be of sufficient density to remove particle sizes down to five microns. Where conditions require, special papers and other materials will be used. Made of cellulose, the cartridges are claimed suitable for filtering straight mineral oil or heavy-duty detergent oils without removing the detergents and oxidation inhibitors.

As illustrated, the figure to the left is a new cartridge; that to the right a used cartridge. Flow of oil is shown in the center figure, the darkened areas representing dirty oil passing into the pocket or void in the spoked disc. Oil flows up and down through the solid discs and filtered oil passes



into the S-shaped section of the discs and out to the clean oil section of the filter assembly. Solids are arrested in the pockets and when these become filled, oil flow filtration continues through outer area until it is also coated with solids. The result is said to be a completely exhausted filter cartridge, with no waste of filter material.

Diesel Water Treatment

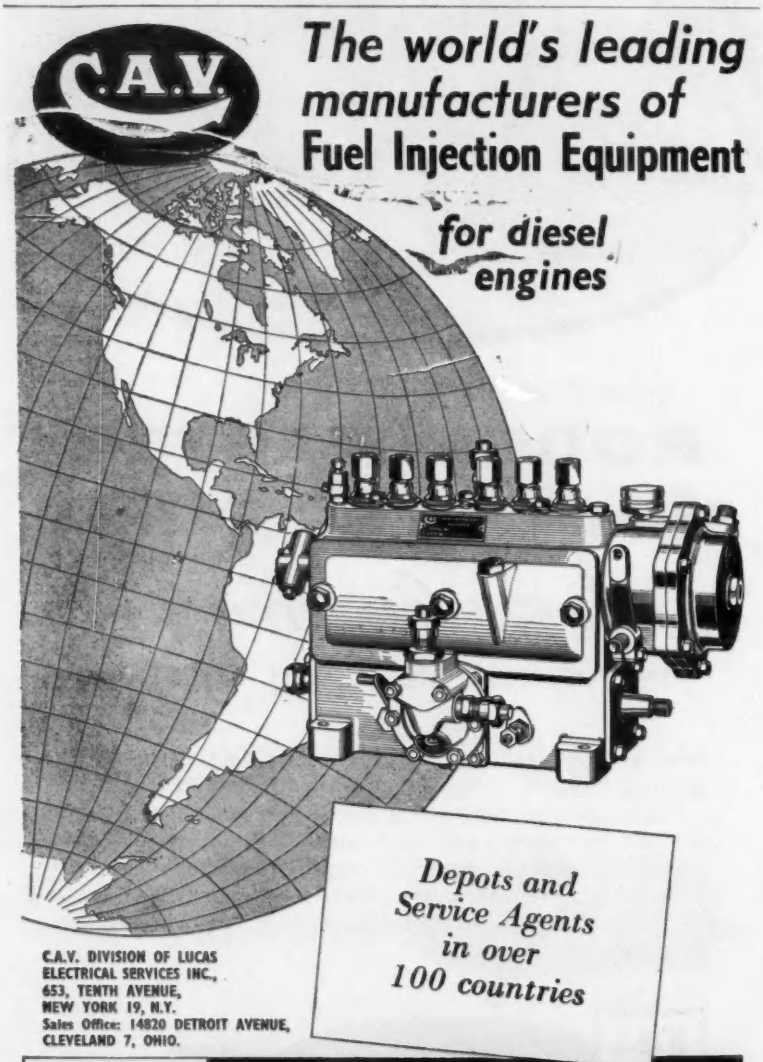
W. H. & L. D. Betz, consultants on industrial water problems, Gillingham and Worth Sts., Philadelphia 24, Pa., announce availability of diesel water treatment No. 68, a buffered chromate-type inhibitor used for the control of corrosion in closed diesel engine systems.

Contained with the product are complete instructions for its use. Under normal conditions, daily control testing is not required. The powder is available in cans of 20 oz each, 40 cans to the case. For large systems 400-lb fiber drum lots are available.

Double Disc Grinder

New Era Engineering Co., 458 W. 29 St., Chicago 16, Ill., is producing an abrasive coated cloth disc grinder, the Neeco-2-Twenty, a 20-in diam double disc machine which operates at 18,000 fpm perimeter speed. When used for grinding tools, sharper and finer finishes are claimed.

Direct-connected to a 10-hp motor, the unit is said to be capable of handling extremely heavy removal loads without reducing disc speed. Its flexibility is shown, for example, when both rapid material removal and fine finish are required. A coarse grit abrasive can be used on one disc and a fine on the other. Optional equipment includes a self-contained dust collector.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new products

Engine Wear Meter

A new engine gauge has been announced by The Gerin Corp., Avon, N. J., which indicates changes in oil viscosity. Because these changes often indicate conditions that cause the greatest wear on an engine—fuel dilution, water or antifreeze leakage, running on dead filters, wrong grade makeup oil, etc.—Gerin has called the instrument a wear meter.

Viscosity is one of the best and most sensitive indicators of changes in the oil. According to the manufacturer, the instrument responds selectively only to permanent changes in the viscosity of the lube oil, which the operator must guard against to avoid rapid wear of major components. In indicating this change, the meter is claimed to ignore entirely temporary changes in viscosity due to temperature. Accuracy within 1% is claimed.

The gauge is permanently attached to the engine. It is actuated by engine oil pressure, cycling to a reading each time the engine stops. It holds the reading so that viscosity can be checked while the engine is idle. However, oil may also be checked without stopping the engine by closing the toggle valve atop the meter.

At every oil change, the fresh oil replacement is used as a standard of comparison. This is done by running the engine a few minutes with the bottom toggle valve open. No adjustments of any kind are said to be necessary to change from any weight of oil to another. In fact, it is claimed, no cleaning or adjustment is ever required.

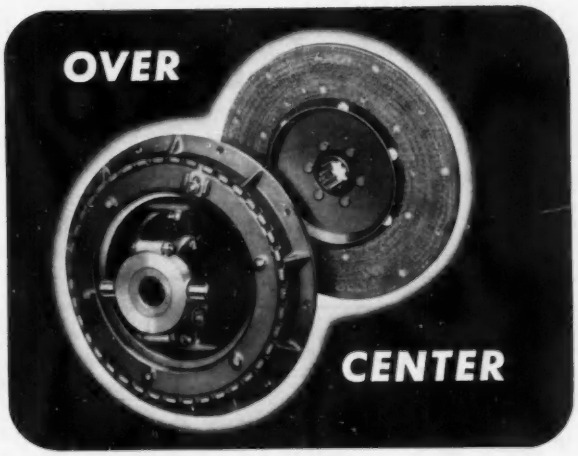
Since the meter responds to both increases and decreases in viscosity, it can measure thickening due to oxidation products or contaminents as well as thinning due to diluents. This makes it practical for use on either diesel or natural gas engines. A 16-page booklet containing further information on the instrument is offered.

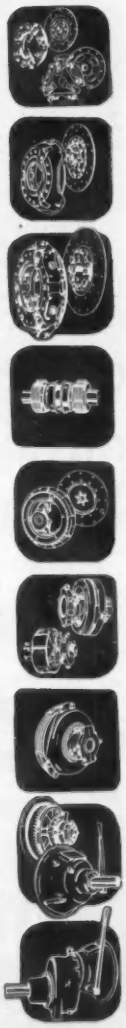
Machine Tool Aligner

King Instrument Co., 804 N.W. Bank Bldg., Minneapolis 2, Minn., is introducing a precision tool, designated King-Way aligner, which it states will give greater accuracy in machine tool alignment in less time than is required by present methods. It was developed for use in machine tool rebuilding shops and for production line checking.

Said to be adaptable to all machine tools without any additional parts, the instrument comes complete with shafts so that various dial indicators may be used. Claimed accurate up to .0003 of .001 per ft of extension, it will measure parallel, horizontal, and vertical alignment at the same time.

ROCKFORD





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news of our industry

Norway Roads Buy Diesels

The Norwegian State Railways are planning to spend about $56 million for new diesel and electric locomotives. A separate $42 million program is now underway for the electrification of some 716½ mi of track scheduled to be completed by 1967. This will still leave almost 1243 mi of lines on which diesel rolling stock will be needed.

The new program envisages the saving of about $7 million in operating costs.

GE Tests Locomotive

To evaluate components used in locomotives for export service, General Electric Co. has built a 4-unit diesel-electric road locomotive and placed it in freight service on the Erie Railroad. Its operation over an extended period in normal freight schedules, it is explained, will simulate as many export-type applications as possible.

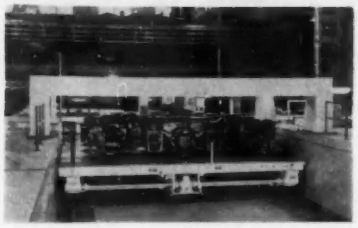
Two of the four units of the 6000-hp locomotive are powered by 8-cyl, V-type Cooper-Bessemer turbocharged engines developing 1200-hp each for traction at 1000 rpm. The other two units are powered by C-B 12-cyl engines developing 1800-hp each. The total weight of the four units is 490 tons; overall length is 212 ft. All are equipped with GE-752 standard heavy-duty traction motors with provision made for full dynamic braking. Static excitation and latest control components are employed.

Superior Engines to Argentina

Yacimientos Petroliferos Fiscales, Argentine government oilfields, has ordered two dual engine pump drives from the National Supply Co. to be used with existing heavy-duty rigs for drilling to depths beyond 15,000 ft.

Each drive includes a Superior PTD-8 naturally aspirated dual-fuel engine in combination with a Superior PTDS-8 supercharged dual-fuel. One drive includes an Ideal E-700 power slush pump, the other will power a competitive pump of similar size and capacity.

news of our industry



Drop Tables in Railway Upkeep

To increase efficiency of maintenance and repair operations on diesel locomotives, modern railroads are making use of the electric drop table as part of their shop equipment. It is used to remove wheels, for changing trucks, springs, and draft gears, and for lowering wheels or trucks for inspection or repair. Major advantage claimed for the table is that it reduces lay-up time.

The drop table is usually used in two ways, when wheels, sets of wheel, or trucks must be removed entirely, or only dropped enough to permit access for inspection, maintenance or replacement of a part. For removal of a part, the drop table moves away on a lowered track at right angles to the locomotive where it may continue to the repair department, or racked to a release track on ground level.

Shown in the accompanying picture is one type of drop table manufactured by Whiting Corp., Harvey, Ill., which requires only a very shallow pit, desirable in smaller shops for quick-running repairs.

Dieselize Cross-Country Run

"The Canadian", Canadian Pacific Railway's new scenic-dome train, going into service April 24, will cut 16 hr off the transcontinental running time between Toronto and Vancouver. Saving in time on the 2881-mi journey, the railroad explains, is brought about by the complete dieselization of the train and by its mechanical air-conditioning which cuts out station stops for loading ice.

The new schedule will mean elimination of one night on the trip. It will be the longest dome ride in the world and the longest train trip behind the same diesel engine. The engine will make the entire crossing and return before going into the shops for servicing. Built by The Budd Co., over $40 million of new equipment is included in the make-up of "The Canadian."

Truck Muffler Warranty

To stress the silencing ability of its new line of replacement mufflers, Donaldson Co. is offering a warranty promising to pay any fines, imposed on a truck using the mufflers, for exhaust noise in excess of legal limits. The warranty covers any recommended Donaldson muffler for a period of six months from date of installation.

Yugoslavia Ups Diesel Output

Under licenses granted by Sulzer Brothers of Winthertur, Switzerland, the Jugoturbina Machinery Works in Croatia, Yugoslavia, has taken up production of diesel engines. The works are normally occupied with building turbines for domestic use.

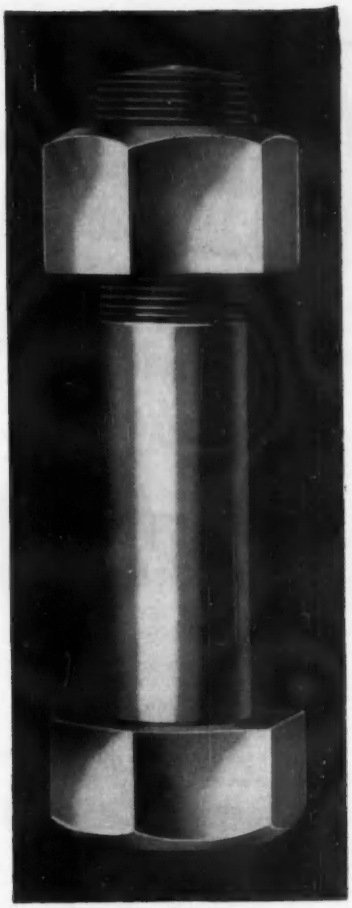
The program of manufacture, it was announced, will first be concerned with 4-cycle diesels of 120 bhp and 240 bhp. Later production of larger units up to 4000 bhp is seen. According to report, this program will dispense with need for imports of diesels into the country.

White-Cummins Agreement

White Motor Co. has reached an agreement with Cummins Engine Co. to permit its dealers and distributors to stock a full line of Cummins parts and accessories for repair and maintenance work. White uses Cummins diesels in a number of its models, including the Model WC-24TD containing a 200-hp Cummins. According to White, the agreement is expected to provide additional revenue in the service phase of White's business this year, which now exceeds $50 million.

Allis-Chalmers Buys Baker

Shareholders of the Baker Mfg. Co. have approved sale of its assets to Allis-Chalmers Mfg. Co. Operation of Baker's two plants in Springfield and Beardstown, Ill. will be begun by A-C in April. The bought-out company is said to be one of the oldest manufacturers of road building equipment in this country.



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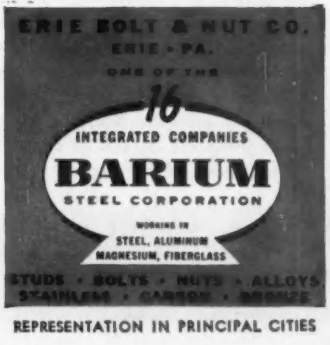

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news of our industry

British Rails to Fire Steamers

The long-overdue technical re-equipment of Britain's railways has come up for consideration by the British Ministry of Transport. A $3 billion long-term modernization project has been submitted which would result in virtually all phases of British railroad operation being transformed.

Replacement of the present 19,000 steam locomotive fleet by diesel and electric traction will take one-third of the amount, with the other $2 billion earmarked for facility improvement. Aim in providing improved track and signaling devices is to permit speeds of at least 100 mph on main routes.

Use of atomic power has been considered for indirect use, namely at electric power stations, rather than to power locomotives. A large number of the 42,000 passenger cars in present use will be replaced by multiple-unit diesel or electric models.

New Orleans F-M Sales Winner

Indicating the trend of industry to the South, the New Orleans branch of Fairbanks, Morse & Co. has taken the company's silver trophy prize for top sales performance in 1954. A gain of more than 20% over the previous year's sales in the area was reported by Robert H. Morse, Jr., president. It was pointed out that last year's trophy went to another southern branch, Atlanta, Ga.

Machinery Lease Plan

The Van Norman Co. has announced a new merchandising plan featuring long-term leases and 10-year installment sales on its machine tools.

Under the project, buyers may choose five ways to acquire machinery: straight cash, 9-year lease plan whereby monthly rentals can be written off as expenses, lease plan with option to buy, 5-yr installment plan with monthly payments, or pay-as-you-depreciate plan with payments up to 10 yr to match tax depreciation allowances.

Diesels Electrify Canada

In the Canadian province of British Columbia, two projects are underway to bring one community out of the oil lamp era and increase the electric power capacity of another.

In the coastal Bella Coola Valley, about 200 residential and commercial customers will receive their first central station electricity from a 350-kw diesel-electric generating plant scheduled to be built this fall. The electrification project is expected to stimulate the fishing and logging community of this relatively remote valley.

At Smithers, increasing power demands will result in extension of the present 1880-kw capacity powerhouse with the addition of a new 1000-kw diesel-electric generating unit to be delivered in August. The growth of the community is evidenced by the increase in customers from 340 in 1947 to 1000 today. An average bill in 1947 was $3.85 for the average 36 kw hr used. Today the domestic consumers are using more than eight times as much electricity for an average bill of $7.35, with the same percentage increase for commercial class users.

Since the province established its power commission in 1945 to improve availability of electrical power, the commission has grown to a $70 million corporation serving about 55,000 customers in 27 power districts, without subsidy. Nearly half the customers represent new services, which either did not have electricity or were not in existence ten years ago.

Municipal Orders 2 Baldwins

The City of Natchitoches, La. has placed an order with Baldwin-Lima-Hamilton Corp. for two dual-fuel diesel engine generating sets. They are both Model G-821-SA, 8-cyl, 21½-in by 27½-in, 2-cycles, each having a net rating of 3870 bhp at 257 rpm and 74.7 bmep.

The two units will increase the municipal's power capacity by 5500 kw. The first engine is scheduled to be delivered and in service by June 1, 1955, the other by October 1st.

news of our industry

Diesels at Alaska Lighthouse

The U.S. Coast Guard's Point Retreat Light Station, west of Juneau, Alaska, is now operating on AC power after having two diesel-electric sets installed to supply all its needs. Formerly the isolated outpost, manned by four men, used small DC diesel electric sets and a 200-amp hr battery for its power supply.

Savings from converting to AC electric sets have come from improved operation and uniform equipment supply and maintenance, plus dispensing with need for replacement of the battery. Waste heat is also utilized to help heat the main equipment building.

The new units are Caterpillar D311 self-regulated, 21-kw, 60-cycle, 3-phase, 120/208-v units. A 4-wire system with neutral is used for main power. Connected load is 90 amp, peak load 60 amp for a 12-hr period. The sets are used alternatively, each running a week at a time.

Point Retreat has been in operation for 50 yr, a link in a chain of 13 such stations in Alaska.

It provides navigational aids: an airway-type light beacon for aircraft and surface vessels, a diaphone fog signal, and a radio beacon. In addition, a weather station is maintained there.

A 5.45-kw Witte diesel-electric set is kept on emergency standby for the light beacon.

GE Traveling School

General Electric Co. has established a traveling extension of its regular maintenance school to aid railroads requesting instruction on operation and maintenance of its diesel-electric locomotives. The company sets up class room on railroad property with texts consisting of instruction books. A semester on the average lasts one week.

Regular courses at GE's Erie locomotive center are also determined by customer demand. Training is usually given on a specialized subject although sometimes the entire field of locomotive and car equipment is included in the same course.

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organizational news

Diesel Power President

At a recent directors meeting of Diesel Power, Inc., Russell C. Vance was elected president.

The new executive head is a former district manager of Joy Mfg. Co., with which he has been associated since 1941. Prior to joining that company, he was assistant manager of Cardox Corp.

Russell C. Vance

Heads Battery Research

Expansion of research activities of The Electric Storage Battery Co. has resulted in the creation of a new research division under direction of Dr. L. E. Lighton, who has been vice president of engineering since 1945. Research for all company divisions will be separated from development engineering and will be carried on in a new center.

Dr. Lighton first joined the company as a sales engineer in 1920 and became manager of automotive manufacturers sales in 1925. He moved to the engineering department in 1935, was made assistant manager in 1940, and engineering manager later that year.

Dr. L. E. Lighton

U. S. Hoffman Manager

New manager of the Hygrade Metal Finishing Div. of United States Hoffman Machinery Co. is C. P. Lavelle. Mr. Lavelle formerly was plant engineer for United Aircraft Corp. and has also been associated with Kaiser Metal Products and Chance-Vought Aircraft.

EMD Elections

The Electro-Motive Div. of General Motors Corp. has announced the appointment of F. W. Walker, Jr. to industrial sales manager. Rene G. Pommier will succeed him at his former post of St. Louis region manager.

In his newly created position, Mr. Walker will be responsible for sales of non-locomotive products, including Electro-Mobile Power units which were recently introduced to electric utilities. He joined the division as an apprentice in 1937, progressed through the ranks to application engineer in 1945, joined the sales department in 1946, and became Chicago district sales manager in 1949. In 1952 he was promoted to St. Louis regional manager.

Mr. Pommier worked for the Heyer Corp. before joining EMD in 1942. He became a service instructor later in the year, was made a general correspondent in the parts department, and in 1947 service engineer. He became parts representative in 1948 and St. Louis sales representative the following year. He was named district sales manager in 1952.

F. W. Walker, Jr.

R. G. Pommier

Clark Opens Atlanta Office

The opening of a new sales office in Atlanta, Ga. has been announced by Clark Bros. Co., with Richard Foster as district manager.

Mr. Foster's experience lies in the heavy machinery field, with particular emphasis on the oil, gas, air conditioning, and refrigeration industries. He joined the company in 1945 after accumulating 16 years in the turbo-machinery field. He was sales manager of the Turbo-Machinery Div. for seven years and has been engineering sales manager for the entire Clark line of products for the past two years.

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organizational news

GM Division Executives

C. V. Crockett is new chief engineer of the GMC Truck and Coach Div., succeeding C. J. Bock who is on leave of absence. At the Detroit Diesel Engine Div. of the company, Semon E. Knudsen has been elevated to general manager, taking over from William T. Crowe who is retiring.

Mr. Crockett began his career at GM as lathe operator for the Cadillac Motor Div. in 1924. He was later assigned to the engineering laboratory, becoming engineering secretary, staff engineer in charge of patents and new devices, and head of the technical data section. In 1941 he was placed in charge of tank armament, was later named assistant chief engineer of the tank plant, and in 1951 was appointed chief engineer.

Mr. Knudsen, son of the late William S. Knudsen who was president of GM from 1937 to 1940, first joined the company as a process engineer at Pontiac. He was successively chief inspector-defense plant, superintendent of car assembly, and assistant master mechanic, before he became director of the process development section in 1949. He was transferred to the Allison Div. in 1953 as assistant manufacturing manager of aircraft engine operations, and appointed manager in 1954.

S. E. Knudsen

C. V. Crockett

Enterprise Export Changes

The position of export manager of Enterprise Engine & Machinery Co. has been given to Max Knopp. In his new capacity, Mr. Knopp announced the granting of a Turkish franchise for all company products to Ali Kefeli, Istanbul.

Mr. Knopp was associated with various Czechoslovakian manufacturers of heavy-duty machinery before and during the war. He later went to Shanghai as a representative of Lister and other heavy equipment builders. Prior to his connection with Enterprise he was manager of the machinery export division of Standard International Corp. in New York.

Oxy-Cat Opens Branch Office

The first branch office of Oxy-Catalyst, Inc. has been opened in Los Angeles. For some time the firm has been represented in the East by Dravo Corp. for industrial installations, and Houdry Process Corp. for petroleum refining installations.

Alfred I. Bratton will be the manager of the West Coast branch. He has been a member of the company's engineering staff for the past three years, and is a specialist in air pollution control and waste heat recovery. He is said to have been instrumental in the research and development of the company's diesel catalytic muffler.

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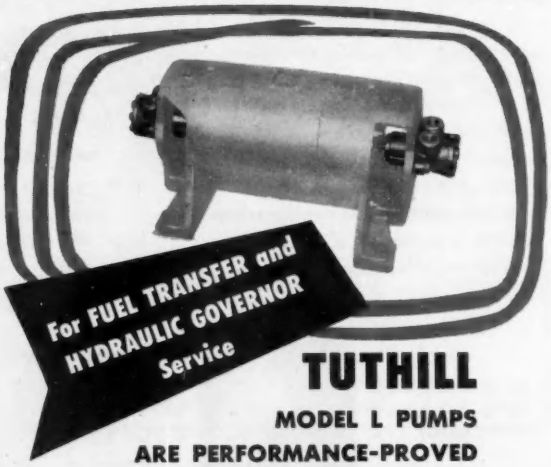

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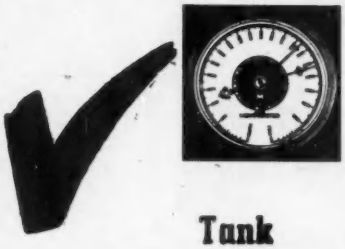

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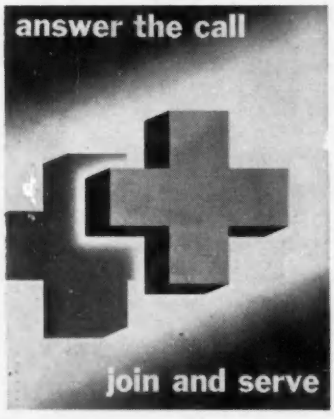

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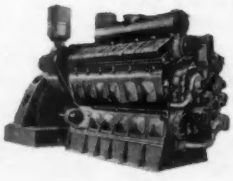

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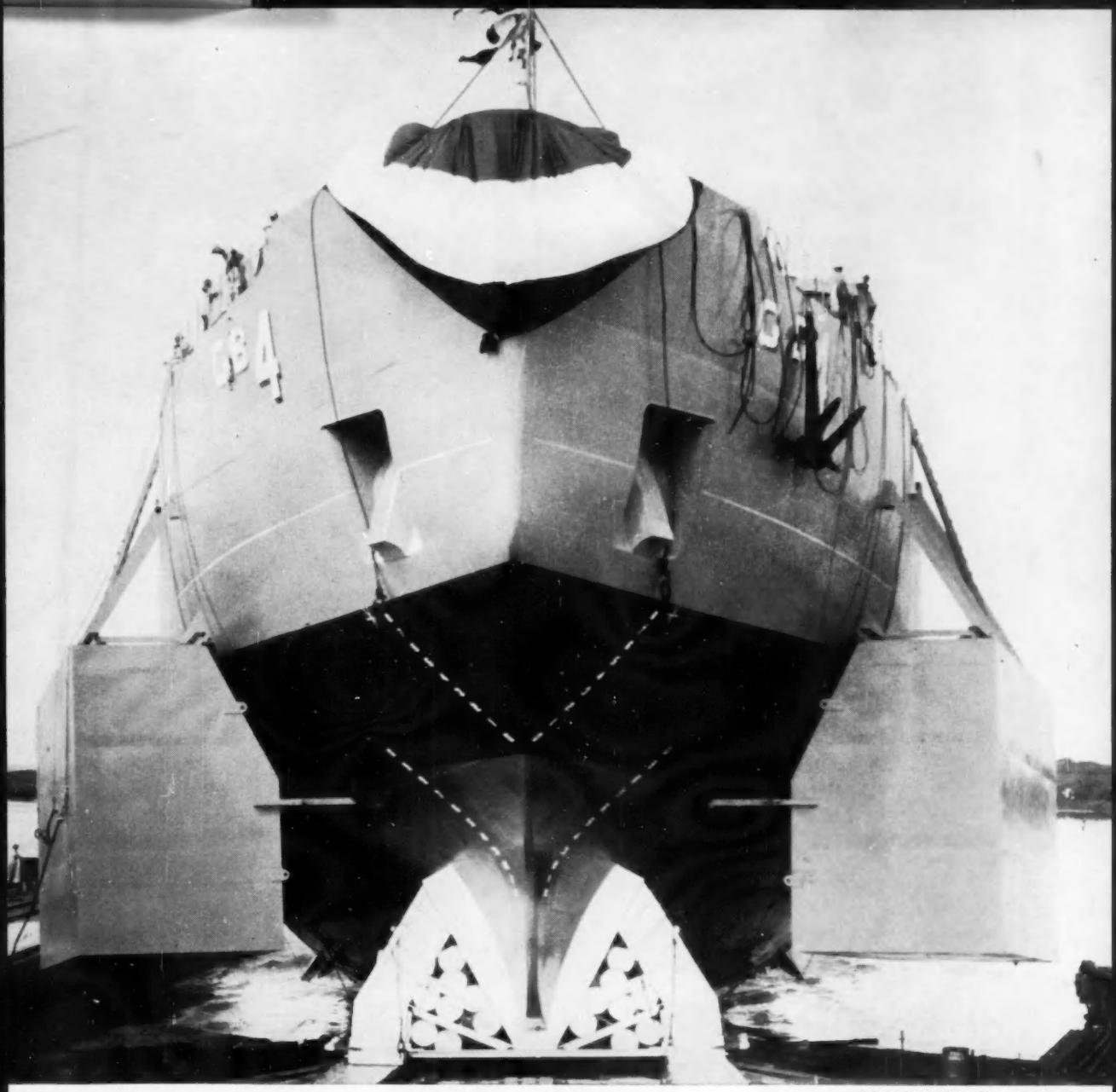

Official United States Navy photograph

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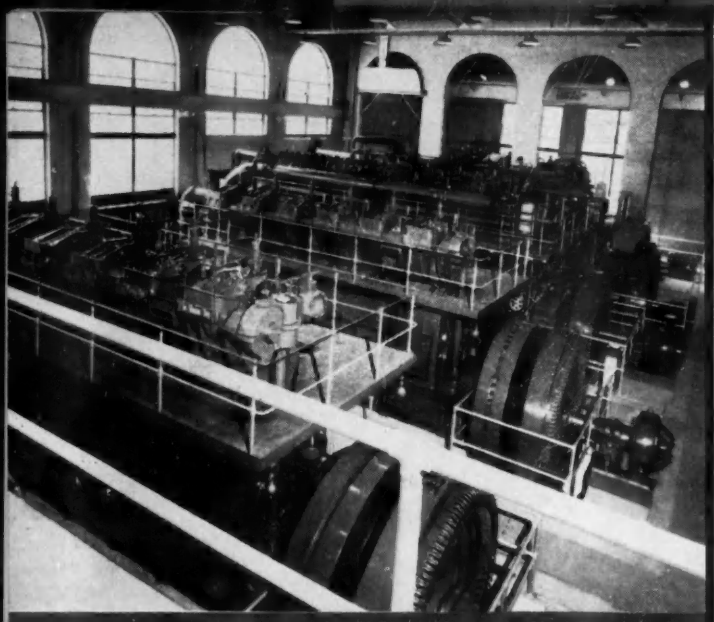

Maintenance of plant buildings and equipment make this light plant a showplace station of which Pierre residents are justly proud.

What Happens When STANDARD HD OIL Is Called In on a Ring Sticking Problem

In 1946, after experiencing considerable trouble with ring sticking, Pierre, S. D., Municipal Light Plant management decided to test STANDARD HD oil in their 2,000 hp. diesel engine. Result: nine years later and after 31,840 hours of operation the original fill of STANDARD HD oil is still in the diesel.

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Perhaps you would like to find out more about STANDARD HD. In the midwest, call your nearby Standard Oil lubrication specialist. Or contact, Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY
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STANDARD

In addition to the 2,000 hp. engine, Pierre plant has a 3,000 hp. and two smaller engines. All are lubricated with STANDARD HD Oil. Floyd Halbert (right), and Standard Lubrication Specialist Bob Kirk, go over Pierre plant operation sheet. Bob Kirk is an old hand at helping people solve lubrication problems. He's been doing this for Standard since 1943. Bob got his engineering training from the University of Washington. He has also completed the Standard Oil Sales Engineering School. Customers find this experience and training pay off for them.